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radio control CAR ACTION

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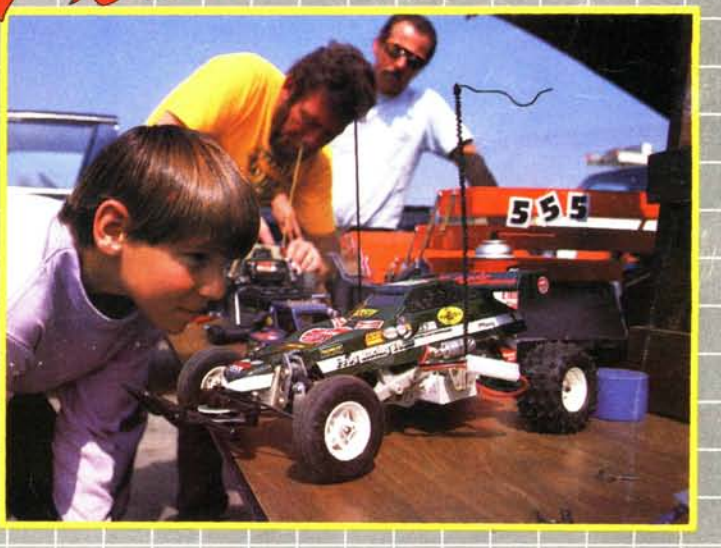
THE WORLD'S PREMIER R/C CAR MAGAZINE

Display until April 17, 1986

- Building Your First R/C Car
- Battery Chargers & Packs
- Awesome MRC Bruiser
- R/C Car Suspensions
- What's New for '86
- Associated RC10

Premier Issue!



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Plenty of "how to do it" modeling tips!

radio control
CAR ACTION

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Winter 1986

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EDITORIAL

by Louis V. DeFrancesco Jr.

We're off!

HERE WE GO! Here's the premier issue of *Radio Control Car Action*—and what an issue it is! We've got "Track Reports" on the hottest R/C cars out today, including the ground-poundin' Bruiser from MRC-Tamiya and the awesome RC10 from Associated, plus an engine review on the latest fire-breather from O.S., lot's of neat new R/C products, wild photos, and bold graphics. We even have a ¼-scale radio-controlled '32 Deuce Coupe with a mini supercharged Chevy V-8 that really runs! It's your wildest R/C car dream machine! And this is only the beginning of what we have planned for you.

The incredible growth and popularity of the radio control car hobby over the past few years has brought about the need for a progressive and dynamic publication that is dedicated to you, the R/C car modeling enthusiast. Our talented and growing staff will be rocketing forward into broad and informative coverage of this fast-growing hobby. We'll be taking an in-depth look at the whole scene through informative articles and brilliant color photos and graphics, covering all R/C car models, products, personalities, and trends.

Radio Control Car Action is your magazine and we want your feedback. Start firing us letters with your comments and opinions; come on, don't be bashful, write! We are committed to providing you with the most informative and entertaining R/C car magazine in the world. So, without further deliberation, welcome to *Radio Control Car Action!* ■

radio control CAR ACTION

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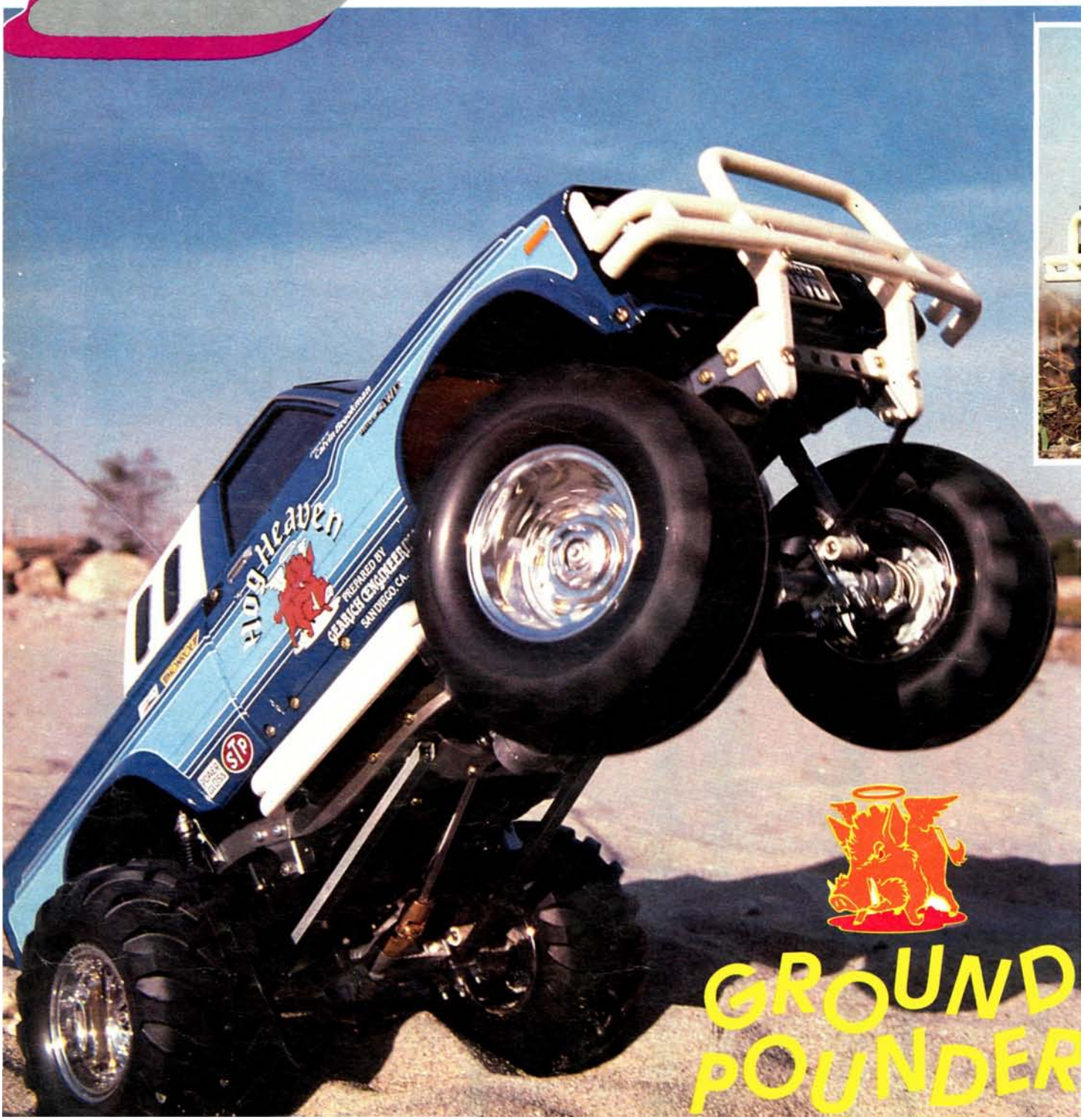
MRC-Tamiya
Toyota 4x4

BRUISER

For awesome, power, speed, and traction, meet the Bruiser!

by Doug Pratt

color photos by Louis DeFrancesco



MRC-TAMIYA* has a very high reputation in the R/C car business. They practically established the off-road category, which has been responsible for bringing literally millions of people into this sport. So when MRC-Tamyia brings in something new, it's news, because many people are going to see it and buy it.

The 4X4 Toyota Bruiser Pickup kit is very different from the R/C car kits you're familiar with. Its most unique feature is its three-speed transmission; with a three-channel radio, you can shift gears while you're running. Since shifting into first gear clutches in the front-wheel drive system, you can shift between 2WD and 4WD from the transmitter. And with the big 400-mAh battery pack, the Bruiser will run for more than half an hour without needing recharging. This is a dream machine for bash-around-the-backyard types!

The Bruiser is a tough car. The big semi-pneumatic tires roll over a lot of obstacles that stop shorter cars. The aluminum ladder chassis is sprung from four separate leaf springs, each of which has an oil-filled shock on it. The bumpers are molded from a flexible resin that doesn't dent or crack. An overload clutch in the transmission protects the motor and transmission from damage. This machine is built to take punishment.

As is usual from Tamiya, a little care can turn the Bruiser into a real scale model. However, the injection-molded plastic body is substantially tougher than a typical static plastic model. It's held together with self-tapping screws, nuts and bolts, and very little glue. The plastic itself is a high-impact type. The Bruiser can be built as a showpiece, but will still go places and take abuse.

CONSTRUCTION. MRC-Tamiya uses a system that makes it easier to keep from confusing the multitude of small parts, nuts, washers, bolts, and screws. Each part is shown on the assembly drawing in the way it's supposed to be fitted in place. Each screw and nut is labeled as coming from a certain parts bag. The parts bags are organized so parts that are very much like each other are in different bags. Each bag header has a full-size drawing of each kind of part it contains. If you're reasonably careful, you'll have no problem getting the right parts in the right places. I make a neat pile of the parts, and put the bag headers in front of the piles.

A pair of diagonal cutters is useful for separating the plastic parts from the trees. Take time to trim the flash off the parts that are used in the structure. It makes it easier to fit them in. When I need one of the parts in the blister packs, I cut a door in the top of the bubble it's in. This keeps everything organized and labeled right up until the time it's needed.

When you attach the leaf springs to the axles, take care to tighten them so they come out straight. They are self-aligning if you get them as straight as possible. This will keep the forces equal on all parts when you're jumping over things. Make sure you're using the right nuts—they're different on the front and back! A hint on assembling the tie-rods: use the scale on the bottom of the instruction page to get the right distance between the ball joints when you assemble them.

Tamiya has the blessed philosophy of including a couple of spares of the really tiny parts, such as snap rings. I recommend that you wear an apron to catch the little devils when they jump off the shaft. Be a bit careful when you fit the top piston into the shock after filling it. I pushed the first one in too quickly and squirted myself in the eye with shock oil.

The wheels go together much more easily than other car kits I've built. Instead of tiny nuts and bolts which have to be held in place with tentacle-like fingers while your third hand turns the screwdriver, the Bruiser wheel components are held in place with three self-tapping screws into thick plastic moldings. The hubs are nicely chromed. Attaching the wheels to the chassis is likewise simplified; each wheel is attached with three, round-head machine screws fitted into threaded holes.

Attaching the ball link to the throttle servo arm would be difficult if you didn't happen to notice that the ball fits right into the little box wrench Tamiya thoughtfully provides. Slip the ball into the wrench and use it to get the thread started into the nylon horn.

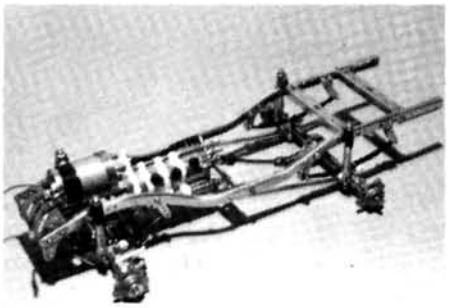
The Bruiser requires a three-channel radio. You can use a two-channel if you have to; there's provision to set and hold the transmission shifting shaft manually, but you'll want the three-channel system.

There is one thing you *must* be careful of here. Get a radio that is on one of the shared frequencies: 72.160 (blue and white), 72.320 (purple and white), or 72.960 (yellow and white). Or you could use a three-channel radio on one of the new cars-only channels (62 through 84). But *don't* be tempted to install a radio on an aircraft-only frequency in the Bruiser, or any other car!

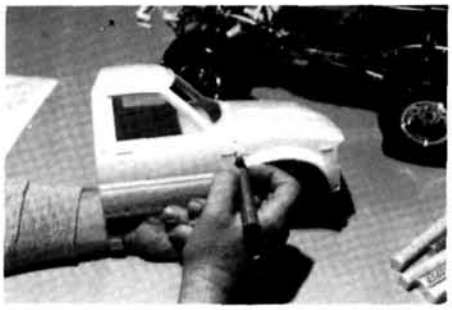
Why not? Because you could crash someone's airplane. That crash could cause an injury, which would probably bring about a lawsuit. And don't think you won't get caught. There are some sorry people on the West Coast who are embroiled in two different suits from just such an accident. The fact is, it's against Federal law to install a radio on an aircraft-only frequency in a car or a boat.

black & white photos by Jennifer Pratt

Parts organization in all Tamiya kits reduces confusion and helps with the assembly process.



Bruiser's frame is a solid aluminum crutch with the transmission bolted on as a sub-assembly.



Detailing with Tamiya's enamel paint pens makes a tedious job very easy; available in many colors.

So don't do it!

So what radio should you use? There are some bargains available from people who want to buy new equipment to take advantage of the new frequencies, so you could probably pick up an older four-channel system easily. Your hobby dealer will probably know who has a system for sale, or he might even have them on consignment. I wanted to go for a new radio. Fortunately, Altech Marketing* imports Acoms radios on the three shared frequencies mentioned above, and will continue to do so because these frequencies are good in Canada and won't change there. The Acoms system is inexpensive, reliable, and drops right into the Bruiser (and other Tamiya car kits). If your dealer doesn't have a new radio on one of the shared frequencies, ask him to order an Acoms four-channel system for you.

Another option is one of the super three-channel radios on the new car-only frequencies. Airtronics* makes two units that will work beautifully, and are fantastic machines. Futaba* and Kraft* also make three-channel wheel radios.

If you go with one of these, you'll get a lot of advantages for the extra money you spend. They come with servo-reversing, which really simplifies your installation, since the middle servo has to operate in the reverse direction in the Bruiser. You'll also get adjustable throttle centering on the Airtronics and Futaba units, which will make it *much* easier to find neutral on the speed controller, so you can freewheel and speed shift. Consider one of these radios, especially if your dealer has one in stock for you.

With a stick-type radio, you'll want to make an easy modification to the left (throttle and shift) stick. You want the stick to center vertically, so it returns to the motor off position when you release it. It doesn't matter if it centers horizontally; in fact, if there's no spring on the horizontal axis, it'll stay in gear easier. You want to remove the ratchet that most four-channel radios have on their throttle stick and put a spring on it. The spring that makes the stick center horizontally will do nicely.

This modification differs with various transmitters, but should always be simple and straightforward. Remove the back of the transmitter and examine the left gimbal. Remove the ratchet device that holds the stick in its vertical position and find the hooks that the centering spring attaches to. Then remove the spring that centers the stick horizontally, and hook it on the vertical hooks. Presto—a transmitter customized for the Bruiser.

There's more slop in the steering system than you'd think there should be. It's due to the crank that connects the pushrod from the servo to the tie-rods. There's also a good deal of play in the front wheel knuckles themselves. It presents no problem when you run the Bruiser, because of the size of these tires and the terrain where this vehicle runs. The only time you'll notice it is on hard asphalt; you have to ride the steering stick just a bit at center, rather than letting the stick center itself or the car won't run perfectly straight. Just be sure that the bolt holding that crank is nice and tight.

RUNNING. First of all, make sure you have put the shift gate on the left transmitter stick. You probably won't damage the transmission by trying to shift gears with the motor running; there's provision for that in the design. But you're likely to end up holding the stick at a point where the transmission is between gears, which leaves you in the middle of the road making grinding noises. The Acoms radio comes with a nice little shift gate with a sticky back; you peel off the backing and fit it over the stick.

Always turn on the transmitter first, then the receiver. If you turn on the receiver and the servos twitch, the Bruiser could take off and hit something before you get it under control. When you're through, switch off the receiver first, then the transmitter.

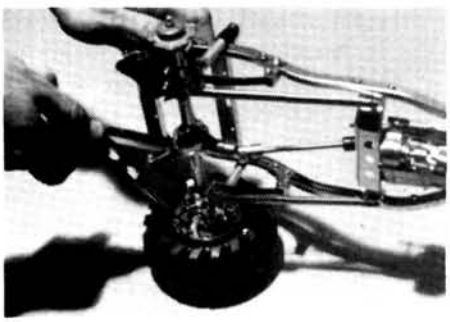
Make sure you've got a good charge in your receiver battery, or if you're using dry cells, that they're fresh. The servos in the Bruiser work hard and soak up a lot of current in the process.

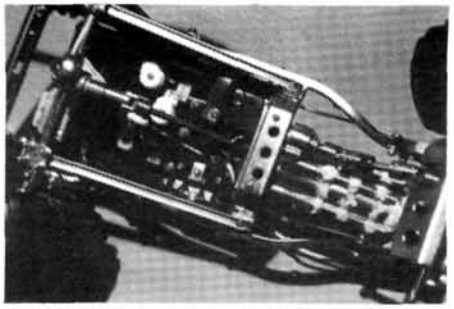
Feel the Bruiser out in second gear.

The wheels for Bruiser are held together with three screws.

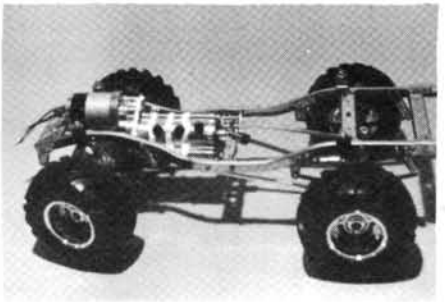
Three more screws hold the wheel to the axle. The entire Bruiser chassis has a full-size appearance.

Ball bearings are found at each wheel and they enhance the vehicle's performance.





Underneath access to servo compartment; adjustments for gear shift, throttle, and steering are easy.



All suspension is the leaf-spring type. Note universal shaft connection to rear wheel differential.

Radio box mounts toward the rear under the truck bed. The On/Off switch is in the bed.

Use the transmitter trim switch to get your centering to the point that letting go of the stick disconnects the motor. By working through the shift gate, you'll soon get the hang of letting the transmission freewheel between second and third, and make smooth speed shifts.

Don't take a run at obstructions! The Bruiser stands tall, but unless you go out and measure every rock, you run the risk of bending the car. Stand back a few feet, switch firmly into 4WD, and go for it.

The Bruiser will run with any of the popular Tamiya battery packs. The new Mabuchi motor in the car draws about the same amps as the usual Mabooches, but produces substantially more thrust. The small Tamiya packs will run the Bruiser, and the battery tray is designed to hold them. But for really satisfying dirt-bashing you need the 4,000-mAh pack. It takes all night to charge, but it will consistently run the Bruiser for 30 minutes-plus. The big pack can be fast-charged with a constant-current charger capable of delivering 4 amps for half an hour; but you should monitor voltage to make sure you don't overcharge.

All in all, the Bruiser is thoroughly fun. It has features that you won't see on your friends' cars, and it'll go places theirs won't. You'll really enjoy building and running this little beast.

**The following are addresses of the companies mentioned in this article:*

MRC-Tamiya, Model Rectifier Corp., 2500 Woodbridge Ave., Edison, NJ 08818.

Altech Marketing Inc., P.O. Box 286, Fords, NJ 08863.

Airtronics, 11 Autry, Irvine, CA 92718.

Futaba Corp. of America, 555 West Victoria St., Compton, CA 90220.

Kraft Systems, 450 W. California Ave., Vista, CA 92083. ■

Track Report

by Charlie Kenney

The state-of-the-art in R/C car radios!

Futaba Magnum FP-3PG

THE FUTABA* Magnum FP-3PG is a very fine radio set especially designed for cars. This particular system is the top of the line of Futaba car radios. The system as it arrived operated on the 27 MHz channel and consisted of a pistol grip type transmitter (FP-T3PG), a four-channel receiver (FP-R104H), two servos (FP-S132SH), a switch harness (R4-SWKB), a battery holder (R4-BHGS), and the following accessories: charger, frequency flag, spare servo horns, and servo mounting hardware. It's quite a complete package. Please note that nickel-cadmium batteries are provided only for the transmitter. The receiver and servos can be powered with alkaline energy type cells or nickel-cadmium batteries. Let's take a look at some of the system's features:

Transmitter FP-T3PG

- Swivel grip system. The pistol grip section and wheel control section turn over a range of 300°. The transmitter operates in any position, great for left-handed operators.
- Wheel angle adjuster. The turning angle of the steering wheel can be increased and decreased without changing the servo deflection angle. This allows the user to adjust the rotation of the steering wheel to the optimum setting.
- Neutral adjuster. The throttle throw/brake deflection angle (back throw) of the throttle trigger can be selected from among three positions to match your requirements.
- Ratchet knob steering dual rate. A selected deflection angle is available when steering dual rate is turned on.
- Ratchet knob steering exponential. The steering angle can be arbitrarily selected exponentially.
- Ratchet knob adjustable travel. The servo left and right operating angles can be independently adjusted.
- Ratchet knob throttle exponential. The throttle throw can be arbitrarily set exponentially.

SPECIFICATIONS

TRANSMITTER FP-T3PG

Operating system: Pistol grip type, 3 channels
Frequency module: FP-TG-AM
Transmitting frequency: 27 MHz band, 75 MHz band
Modulation: AM (amplitude modulation)
Power requirement: 9.6V internal nickel-cadmium battery
Current drain: 200 mA
Dimensions: 8¼x7¾x3¾ inches
Weight: 1 pound, 12 ounces

RECEIVER FP-R104H

Miniature 4-channel AM receiver
Receiving frequency: 27 MHz band, 75 MHz band
Intermediate frequency: 455 KHz
Power requirement: 4.8V
Current drain: 10 mA
Dimensions: 1¼x2x¾ inches
Weight: 1.06 ounces
Receiving range: 650 feet on the ground when used with the FP-T3P

SERVO FP-S132H

Control system: Positive pulse width control, 1.52 MS neutral
Operating angle: One side greater than 40° for FP-S132H (including trim)
Power requirement: 4.8V shared with receiver
Current drain: 6.4 mA at 4.8V (at idle)
Output torque: 25.02 inch-ounces
Operating speed: 0.13 second/60°
Dimensions: 1½x$^{11}/_{16}$x1¼ inches
Weight: 1.13 ounces

CHARGER FBC-8B(2)

Input voltage: 117V AC, 50/60Hz
Output: Transmitter side—9.6V, 45 mA; Receiver side— 4.8V, 45 mA

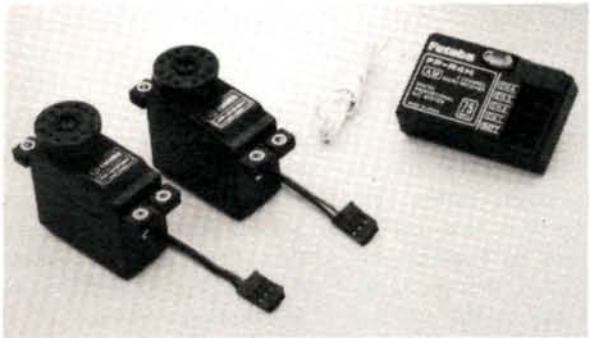
- Servo reversing switches are provided for all channels.
- Warm-up switch (gas engines). The engine is warmed up by automatically revving the throttle and a monitor lamp flashes to indicate the switch is On.
- ATL (adjustable throttle limiter) on brake trimmer. Since the brake trimmer operates as a trimmer only at the low side, linkage hookup is extremely easy and the amount of brakes applied can be adjusted while running.
- Brake limit trimmer. Sets maximum brake deflection angle (low throttle position).
- Throttle high side trim knob. Throttle system linkage is very easy to hook up. Adjustment while running is also possible.
- Removable RF module system.
- Replaceable crystal. Crystal can be changed from the outside on 27 MHz only.
- Three-channel AM transmitter. Channel 3 uses a click knob and is best used as an auxiliary channel like carburetor trim.
- Separate battery unit. The transmitter nickel-cadmium battery is mounted at the bottom of the grip and can be removed easily. The nickel-cadmium battery can be carried in a pocket by using the optional curled cord. (FTA-2, FP-T3PG, battery extension cord).

Receiver FP-R104H

- High performance AM four-channel receiver is small in size and lightweight.
- Short (50 cm) antenna designed for cars or boats is easy to mount.
- Uses a narrow band ceramic filter for maximum protection against adjacent channel interference.
- Noise resistance achieved by using a pulse noise rejection circuit.
- New CMOS miniature IC used in the decoder increases reliability substantially.
- New type subminiature, high reliability pins used at the crystal socket also increase reliability. The crystal can be changed from outside the case (27 MHz only).
- Thick film gold-plated connector block pins eliminate poor contact and improve reliability against shock and vibration.

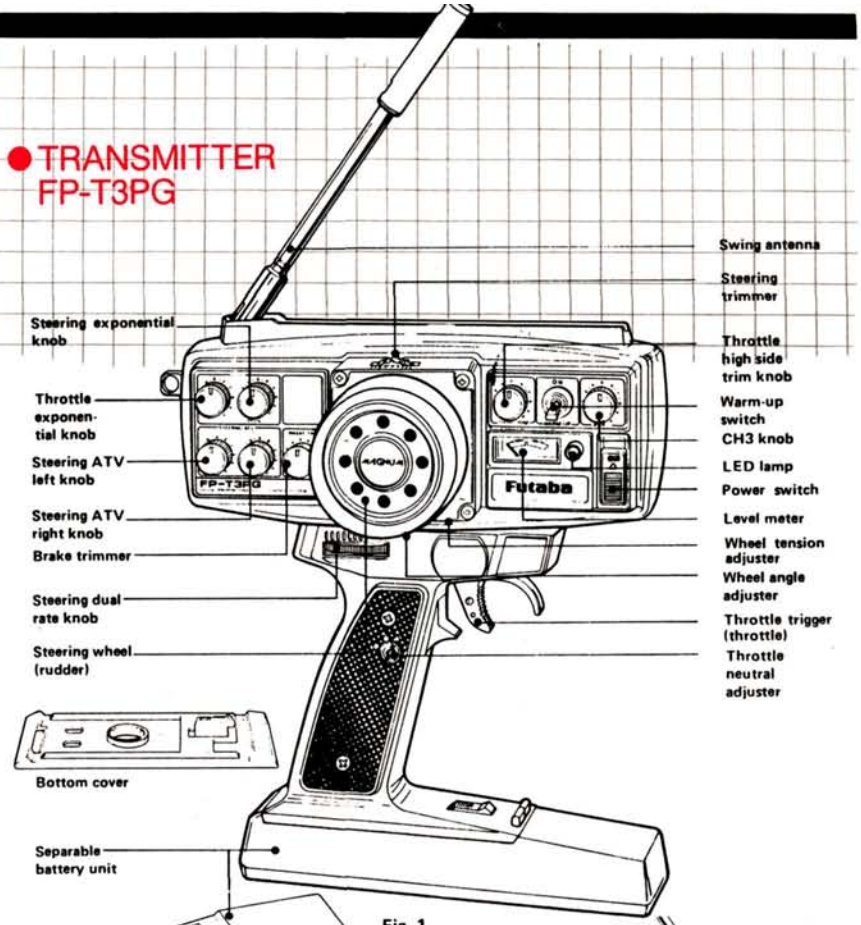
Servo FP-S132H

- The S132H is a small, high quality, high speed servo. Output torque: 25 inch-ounces (1.8 cm-kg), operating speed: 0.13 second/60°.
- New indirect drive potentiometer improves vibration and shock resistance and increases neutral precision.



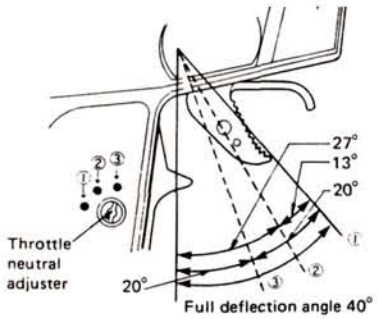
Included in the system are the FP-R104H receiver and FP-S132H servos.

● TRANSMITTER FP-T3PG



- Futaba low-power custom IC provides high starting torque, narrow deadband, and excellent trackability.
- Fiberglass-reinforced PBT (polybutylene terephthalate) injection molded servo case is mechanically strong and invulnerable to glow fuel.
- Strong polyacetal resin ultra-precision servo gears feature smooth operation, positive neutral, and very little backlash.
- Thick film gold-plated connector pins eliminate poor contact and improve reliability against shock and vibration.
- Four special adjustable splined horns are available.

The Futaba FP-3PG's most unique feature is the pistol grip transmitter. The car radio unit is quite conventional; a receiver, a switch harness, a battery pack, and two servos. It's no different than what you might use in a model plane or boat, so I would like to spend most of this review on the transmitter and its controls.



THROTTLE TRIGGER POSITIONS

The most obvious place to start is with the wheel and the trigger throttle. The wheel is spring centered and can be deflected left or right by twisting. Incidentally, it is presumed that the servo reversing switches are in the normal position for all of the following descriptions. The throttle trigger is moved by squeezing the trigger. The throttle neutral position can be set to any one of the three positions by turning the throttle neutral adjuster with a dime or a small blade screw driver. The throttle neutral adjuster control is located on the pistol grip just to the left of the bottom of the trigger. The slot in the adjuster identifies the position. Position 1 is full counterclockwise. Positions 2 and 3 are reached by moving the control clockwise to position 2 and then 3. Each position is detented (click). Position 1 has a full trigger deflection angle of 40°; when set to position 2, throttle is 27° and brake deflection is 13°; when set to 3, the throttle and brake throws are both 20° (see illustration). It is recommended for engine-powered cars that position 2 be used. Position 3 is usually used for electric power.

The throttle exponential knob allows the position of the throttle servo to follow a movement of an exponential curve. The more clockwise the position, the more movement for a given deflection of the trigger. Full clockwise is maximum exponential. Full counterclockwise is linear or no exponential.

Moving to the right, we have the steering exponential control. It operates similarly to the throttle control, except exponential control setting affects both the left and the right side of neutral.

(Continued on page 54)

Building Your First R/C Car!

by Art Schroeder

A trainer or a simple vehicle is not needed; virtually any of today's kitted cars can be built and operated by a novice driver. The Cox Gallop is a case in point.

These tools are necessary for assembly of any R/C car. Overall cost is not high, so buy the best.

Zap Lock keeps nuts and bolts in their proper places. Plasti Zap was used to join plastic parts. Both were effective.

SO, YOU inadvertantly came upon a group running their little R/C cars in a parking lot and now you have a hankering to try those speed machines. The color, action, speed, and sound have really captured your imagination, but where do you start? A visit to your local hobby shop reveals dozens of cars and an equal array of radio systems. It's enough to boggle your mind! Still it looks like an awful lot of fun.

Well, I'm here to tell you that the beginning point is really quite simple to determine. In a nutshell, the first car for you is the style you like best at a price you can afford! Virtually any car in kit-form today can be built and run by any beginner. Of course, some are easier than others so let me make a few suggestions.

Road racers are not the best first choice, particularly gas-powered cars. They have minimal road clearance, are very fast, and require some background and experience to properly adjust. However, if your local group is into this kind of car, go ahead—they will be of far more help than I could ever be.

The foregoing immediately shows my preference for beginners—electric-powered off-road vehicles. In the alternative, I find that trucks and jeeps are also great beginning points. Which brings us to my most recent project, the Cox Gallop; a four-wheel drive, four-wheel steering, off-road car that is simply great!

Lest anyone misunderstand, I don't place the Cox vehicle as an absolute starting point. Indeed, I have seen a number of off-road or truck types from a variety of manufacturers that would do just as well for beginners. MRC's Ford Ranger and Wild Willy are examples. Nor does my suggestion that these cars are suitable for beginners make them lesser vehicles; they are also thoroughbred racing machines for experts. Simply stated, expert drivers will get maximum performance but beginners will be able to effectively learn on cars such as the Gallop.

The Cox Gallop includes finished parts in nylon and metal that fit perfectly. Most of the building is done with nuts and bolts and self-tapping screws. Some cyanoacrylate glue is used and a bit of thread-lock liquid is used as well. All parts are bagged or displayed in heat-shrink containers and are keyed to the instructions. Most importantly, the instructions are well written, logical, and carry you through assembling the Gallop to a finished car in under 10 hours. Not only is the verbiage well done, the isometric drawings make it virtually impossible to make a mistake.

Why do I suggest off-roaders? Frankly, they're fascinating to build and all I've seen come in complete kits (except for radio, batteries, and some paint)

Cox Gallop Four-Wheel Drive, Four-Wheel Steering Off-Road Racer

color photo by Louis V. DeFrancesco Jr.

This is an off-road car for everyone and anyone—easy to build and adjust—easy and exciting to operate!

THE COX HOBBIES* Gallop is a four-wheel drive, four-wheel steering (4WDS), electric-powered off-road vehicle that is simply super in presentation and operation. The four-wheel steering is unique in model cars and, while a bit more complex than conventional steering, it provides some definite advantages in off-road racing.

The Gallop has a chain drive through two differentials, along with independent rear suspension and front torsion bar suspension on a double wishbone. The car is absolutely designed for off-road racing with the ability to keep all wheels on the road and to handle just about any shock thrown into its chassis.

The kit is principally made up of beautifully molded nylon parts with metal employed at strategic positions. All parts fit perfectly. Indeed, if something didn't fit, it was the wrong part. Assembly took an enjoyable 10 hours, but others may be able to do the job in less time.

Power is provided through a 7.2-volt battery with 1,200-mAh capacity to a Mabuchi RS-540 S motor. The car wheelbase is 10.3 inches, with an overall length of 15.6 inches; overall weight is 58 ounces, and it is balanced so that 60% of its weight is on the rear wheels and 40% on the front.

The instructions are among the best I've seen. Not one deviation from those instructions was needed. I can only provide the caution that you should be very sure of the polarity discussed on page 16. This is a black/white presentation, yet positive voltage to the speed controller could be misunderstood. On page 16, the black lead is the positive one! I also caution builders to be sure that (page 18) the inner ring used is the proper one for the tire being assembled.

Outside of that, everything went together perfectly. That perfection was seen in the flawless running of the Gallop. I established all adjustments as outlined and the results were fine. Although I've not yet raced the machine, I see no reason why it should not do well.

One characteristic that was outstanding was that I could not spin the Gallop on any turn no matter how "hamfisted" I tried; a tribute to design and balance. The four-wheel steering gave Gallop an unusually tight turning ability yet, as adjusted per the instructions, it was quite easy to hold the car on a straight course.

In truth, the Gallop is an almost perfect machine for both novice and expert. Not only do the instructions tell you how to assemble the car, but they include tips on tuning and installation of options for out-and-out racing. I can recommend this car to anyone—I certainly had a ball with it.

*The following is the address of the company mentioned in this article: Cox Hobbies, Inc., 1525 E. Warner Ave., Santa Ana, CA 92705. ■

with well written instructions. When completed, off-roaders can be run almost anywhere; your backyard, driveway, or a local parking lot will serve nicely. They're maneuverable and give the added dimension of jumps and even wheelies. A regular track racer requires a very smooth surface that might not always be available, and it definitely requires other cars to race with. Without the elements of a race, a road racer can quickly become somewhat boring—an off-roader holds your interest as as you simply try to negotiate a rough course.

Why do I suggest electric power? Simply, electrics are less complicated to operate. If you have prior model engine experience you might want to opt for a gas car. I have many years of experience but I still prefer the electric cars—they are cleaner, quieter, simpler, and just as much fun.

Once a choice has been made, the rest of your problem is assembly and operation. I have yet to see a model car that goes beyond the ability of anyone who can read and use a screwdriver and a pair of pliers.

When a car kit is first opened, the myriad of parts can really set one back. Don't despair! It is all very simple and should be thought of as a large, three-dimensional jig-saw puzzle. Although there are many parts,

(Continued on page 28)

The ultimate off-road R/C vehicle!

by Mike Lee

OFF-ROAD RACING! It's fun, it's exciting, and it's highly competitive. As the fastest-growing aspect of the R/C world, off-road racing offers non-stop enjoyment for people of all ages. By the same token, it makes for the toughest proving ground for new car designs in the marketplace. This Road & Bench Review deals with the newest entry on the off-road racing scene, the Associated* RC10 off-road vehicle.

The RC10 is designed to be the only all-around vehicle for off-road racing. She is solidly built and designed to be easily adaptable to any track situation.

THE KIT. My RC10 is the deluxe kit, featuring all necessary parts and accessories for assembly, except the radio. It includes the car, the motor, a 6-cell battery, a charge cord, ball bearings, and a full body kit. Also included is the best instruction manual I've ever seen for cars. It's clearly written in simple terms and easy steps. It's also accompanied by an illustrated manual.

CONSTRUCTION. Assembly begins with the front end components and the main pan, which is a one-piece monocoque aluminum chassis, anodized in a striking gold. All parts attached to the pan are held down with tempered hardware, countersunk into the pan. The result is a flat bottom chassis with nothing hanging down to get torn off.

The front end features fully articulated movement with independent suspension. The moving parts are hinged with hardened pins held in place with circlips. The result is very smooth movement of the front suspension arms. The camber, caster, toe-in, and toe-out are controlled by threaded tie-rods attached with ball joints. Adjustment of the front end is easy to perform and can be very precise.

Steering is handled by not one, but two Associated servo-saver tiller arms. This allows each individual bump and shock to be absorbed by each wheel, rather than the whole front end.

The front shock absorbers are a new design by Associated. These feature hardened drill blank shafts with double end seals and machined aluminum bodies.

Moving to the rear end, you will again find a fully articulated A-arm type suspension. As in the front end, the rear is easily adjusted for travel and caster.

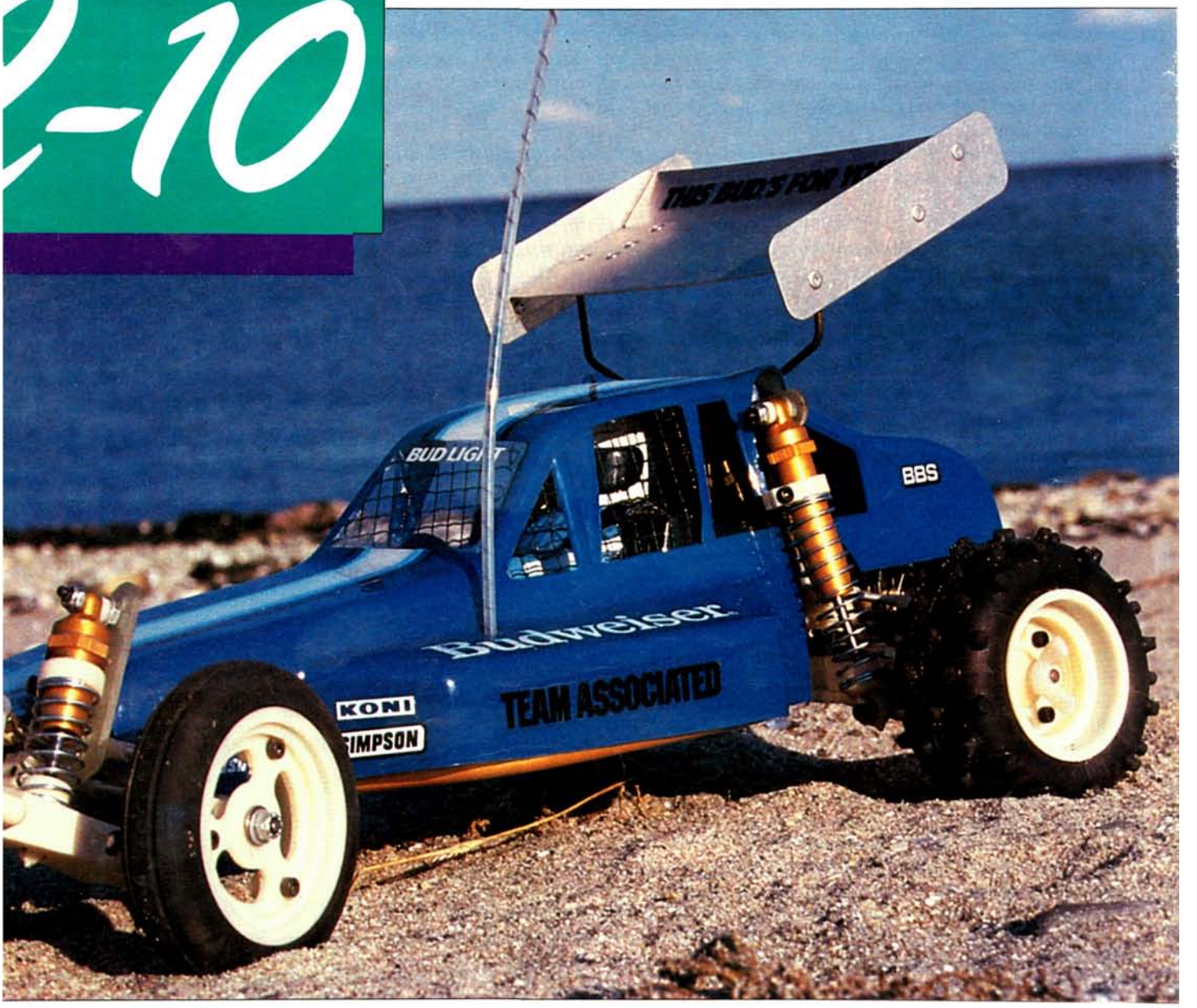
The transmission is the heart and soul of the RC10. Not unlike its road-racing cousins, the RC10 shares the famous Vari-Diff ball differential by Associated. This differential can be set to render a wide range of control on the rear wheels, including a full lock. The differential makes its contribution to the rear wheels via four spur-toothed gears, the last of which ends up providing the motivation. There is no lack of care here, as the axle drive gear is sealed with a felt dustcover to protect the transmission.

Motivation to the wheels is handled by separate dog-bone type axles, which negate the need for universal joints. Getting to the rear wheels, we find high knobby tires mounted on heavy-duty nylon wheels. Associated has thoughtfully thrown in axle adapters to allow the use of other brands of wheels. The front tires are narrow ribbed tires, again mounted on heavy-duty nylon wheels.

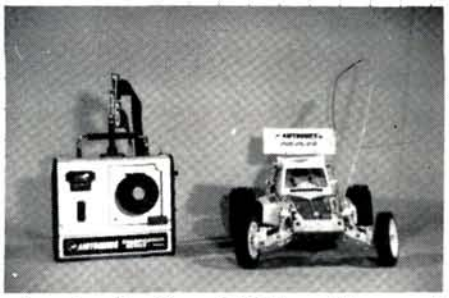
color photos by Louis V. DeFrancesco Jr.

d Electrics

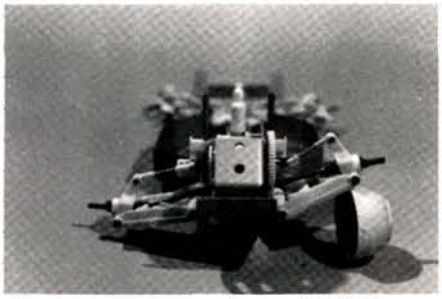
2-10



Associated Electrics R/C-10



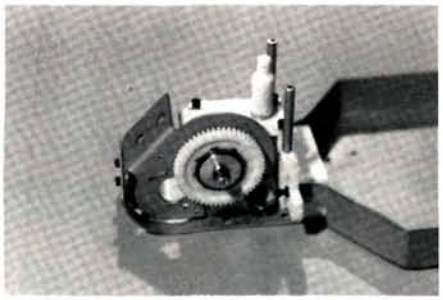
Associated's off-road RC10 combines good looks, high performance; Airtronics controls.



The long suspension throw of RC10's rear-end is evident in the photo.

As far as the business end of the car goes, the RC10 is furnished with an Associated/Yokomo off-road stock 05 motor. This motor features everything legally allowed under the present R.O.A.R. off-road rules for Stock class vehicles. It has a modular end bell, shunted brushes, remagnetized magnets, and all the other speed secrets you always wanted to have.

The radio used in my RC10 is the CSW-3 wheel radio from Airtronics*. It features dual rate steering, reversing on all three functions, end point adjustment, exponential servo rates, and total throw adjust on the throttle. Added to this is discreet servo actuation, which means you can operate the whole system without transmitting a signal. Still more exciting is the ability to check the receiver battery from the transmitter, front facing and exposed dual rate adjustment, quick change frequency modules, . nd clean FM modulation.

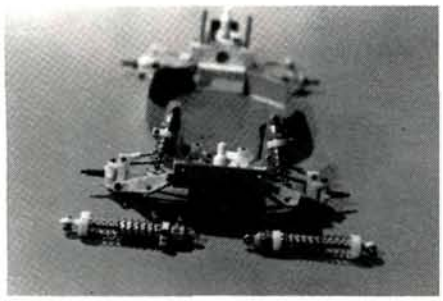


Drive train is a relatively simple but effective design and provides performance plus.

Handling the Airtronics car radio is easy. By cradling the transmitter in the left arm, the throttle is worked with the left hand and the steering with the right. The steering wheel comes with a nice foam wheel cover to fight fatigue and broken fingernails. The receiver supplied with the CSW-3 is a double-tuned miniature receiver. It features plug-in crystals for fast frequency change, light weight, and great range.

The Championship CSW-3 has the standard type 94394 servos. These servos provide over 45 inch-ounces of torque output, splined output shaft, carbon wiper and pot assemblies for accuracy, and rugged construction.

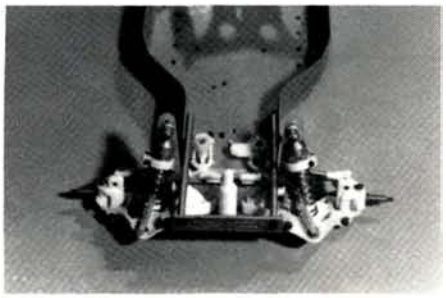
An interesting note about the RC10 and radio installation: a great deal of forethought has been exhibited here in that the RC10 has servo mounting holes designed to allow fitting of at least 6 different brands of servos, ranging from standard size to sub-miniatures. I've seen no other car that has this kind of versatility in this department. The Airtronics radio fit like a glove.



Independent suspension is provided both front and rear.

Now that the chassis is complete, the final thing to do is paint and mount the body. The Associated RC10 comes with a Lexan plastic Funco type body. You better believe this body will last because it is *thick*! It's not a brick, mind you, but it will take some time to wear out this one. I used acrylic enamel to provide the tinting, and dressed it up with the supplied sponsor stickers from the kit.

PERFORMANCE. As compared to my other dirt burners, the RC10 is outright faster. But, speed isn't everything, I know. The RC10 seems to handle very well, right from the bench with no suspension tuning. The tires provide solid bite, and the vehicle shows no sign of severe rolling. Note that the RC10 has an anti-roll sway bar on the front, and you can see the difference this makes.

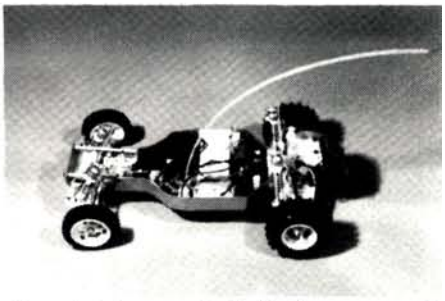


Front-end suspension is through two oil-filled shocks and is fully adjustable.

Most of us like to see how they jump, and I'll be the first to admit this. The RC10, with a moderate degree of wing deflection and mid-ship placement of the battery pack, seems to welcome jumps. She sails slightly nose-high, landing firmly on the rear wheels. Dampening from the shocks is well appreciated here, in that the RC10 showed no sign of bouncing back up with a resulting loss of traction. Even on those sharp hops that cause the nose to fall first, the RC10 seemed to handle in stride.

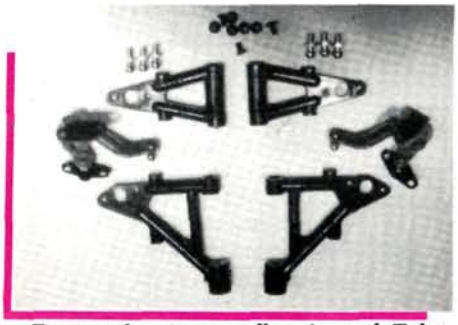
The RC10 is solidly built, designed to last, and performs like greased lightning. My Airtronics CSW-3 Championship Series radio is a great complement to the RC10. It provides a solid radio link with precise control and a comfortable feel. I highly recommend it. Together, they'll make a potent racing team that requires only a willing driver to bring her home to the winner's circle. Take one for a test drive—"it's awesome!"

**The following are the addresses of the companies mentioned in this article:*
Associated Electrics, 1928 East Edinger, Santa Ana, CA 92705.
Airtronics, 11 Autry, Irvine, CA 92718. ■

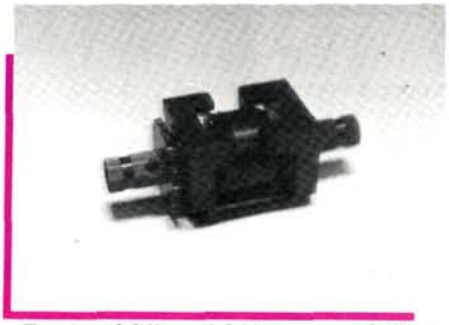


Completed car sans body. Radio components and batteries are well protected.

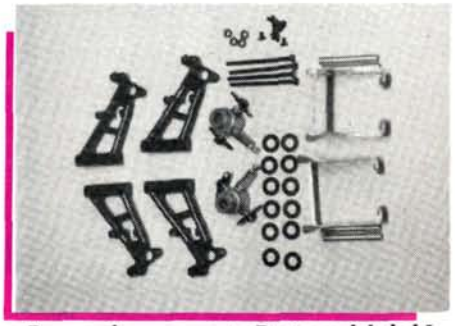
Building Your First R/C Car!



Front-end parts are well engineered. Take care to insure right and left positioning.



Front-end differential. Note gear on left for chain drive.



Rear-end components. Parts are labeled L and R to insure proper positioning.

Continued from page 23

they all fit in a specific place to perform a specific function as specified in the instructions.

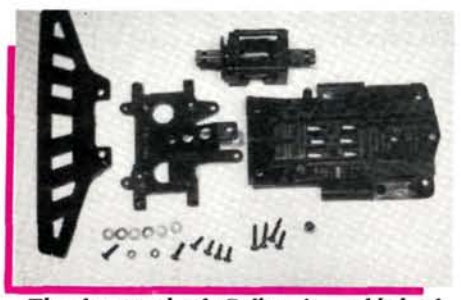
That is to say, read the instructions over and over again. At the same time, try to relate those instructions to the bagged parts and larger parts you can see. Once you are comfortable with them, read the instructions again. I've built numerous Tamiya (MRC) and Kyosho (Cox) vehicles; in all cases the instructions were superb! Above all, don't start spreading parts out by un-bagging them—such procedure will cause a lot of problems and confusion. Parts bags are usually keyed carefully to the instructions and should be opened only when a certain step is reached. Once opened, I suggest you keep the parts in a small plastic cup until you need them. One thing most important to successfully assembling an R/C car is organization—keep this in mind.

To assemble an R/C car you need a flat work surface of at least 48x24 inches. This place should be yours and one that no one else will disturb. Almost any area is okay since R/C car assembly is basically a very clean activity. Just be sure it is a place not needed by anyone else for several weeks. Not that an R/C car takes that long. I've never spent more than 18 working hours on any car I've assembled, and that includes most of the popular machines running today. However, spare time is sometimes hard to come by, so a safe area where things can remain undisturbed over time is necessary.

The number of tools needed is somewhat embarrasing for something that seems so complex. I completed the Gallop with nothing more than a small and medium Phillips screwdriver, a pair of needle-nose pliers, an adjustable wrench, a small slotted screw driver, an X-Acto knife, a lightweight soldering iron and rosin core solder, a small wire stripper and cutter, one small brush, and that's it. The tools were worth, perhaps, $35. One caution—be absolutely certain your screw drivers (slotted or Phillips) fit the screws in your kit.

Most kits don't include paint, but there are a variety of plastic paints available at most hobby shops. The acrylic or polycarbonate paints are best for R/C cars; all apply beautifully with a brush.

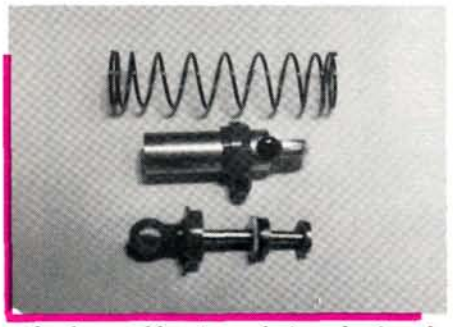
I can't in one short article carry you through the assembly of any given car, but the instructions will. Proceed carefully. If any part doesn't fit, re-read the instructions. Any foul-ups are usually because you selected the wrong part. Follow the instructions to the letter—and that includes following the order of assembly. Any deviation will usually cause you problems.



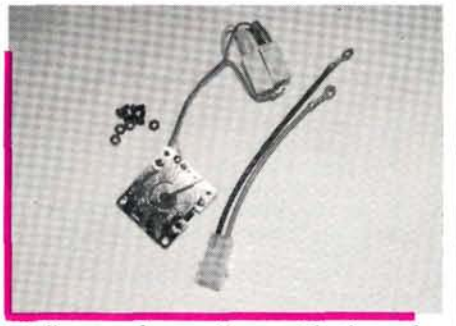
The front-end of Gallop is molded of rugged heavy-duty nylon.

Rear-end wheel bearings and steering knuckles. Ball bearings are an option that can be included.

Completed rear end and motor assembly. Note chain drive and universal shaft to rear wheels.



Shock assembly prior to the introduction of damping oil.



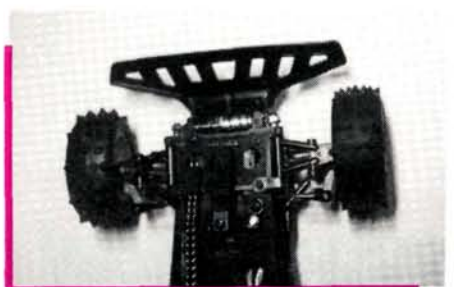
Gallop speed controller provides 3 speeds forward, 1 reverse, and receiver voltage.

Usually any oils that you need are included in the kit, along with a thread-locking cement. Again, follow instructions as to their use. Oils won't cause you a problem, but thread-lock fluids can attack plastic—a principle material in R/C cars. Whenever using a locking fluid on a metal-to-plastic connection, be very sure the fluid does not attack the plastic. Usually there is some scrap plastic on the "tree" from which parts are cut that you can test paints and cements on.

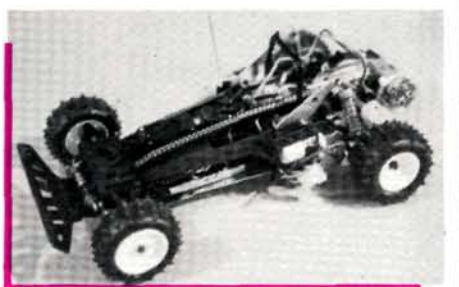
Tighten all nuts and bolts firmly with an appropriate screw driver while holding the nut driver with a pair of pliers. Avoid tearing up screw slots! Not only does that give you an unsightly job, it also makes removal difficult, if not impossible. Self-tapping screws into plastic should be firmly set, but not so firmly so as to strip out the plastic threads. Most nuts and bolts are safety-set with a thread-lock cement; most screw/plastic connections will not call for this. The instructions will guide you to spots that use thread-lock cement.

As for radios, start with a two-channel, proportional radio with two sticks or a wheel. I strongly suggest that you get a set with rechargeable nickel-cadmium batteries, as the purchase of many sets of alkaline dry cells over extended running will soon sour you on the entire sport. In my opinion, nickel-cadmium batteries are the better value. If possible, get your radio with servo-reversing; a most useful feature that will become obvious the first time you set up a car.

So that's it. You can assemble anything you want with a minimal number of tools and a limited work space. No skills beyond the normal ability to use a screw driver and to read instructions are needed. It is a hobby/sport for everyone—and anyone. ■



Completed front end assembly exhibits ruggedness and shock absorbing design.



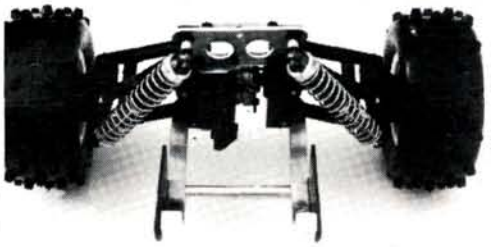
Complete Gallop chassis. Vehicle is both four-wheel drive and four-wheel steering.

KYOSHO VANNING

(Continued from page 45)

The next steps are to install the bumper and the engine servo saver, and to mount the servos. When purchasing a radio, it's best to buy one with reversing switches for servos because the steering servo is mounted backward and will therefore cause steering to be backward. When adjustment of the linkage is complete, install the fuel tank, tires, muffler, rollcage, and body, then off to the nearest beach!

PERFORMANCE. After ironing out some engine carb jetting problems, this fire-breather was ready to scorch some sand! My first impression of this little monster left my jaw on the ground. As I leaned on the throttle, the engine began to cough, expelling the raw fuel it had built up from idling. Then the engine began to clear itself and build horsepower. As it started to rev up, it began to spit four immense rooster tails from its knobby tires.



Rear view shows oil-filled coil-over shocks, rear disc brake, and molded nylon A-arms.

Though the beach is not the roughest terrain, I encountered some obstacles that would have stopped most of the two-wheel drive cars right in their tracks. The first obstacle was a mound of seaweed that engulfed the car due to driver error. Instead of losing hope, I figured it might make it out on its own so I nailed the throttle and without hesitation the car leaped out of the mound of seaweed like a cat in the dog house.

The second obstacle was a pile of sand standing about 6-feet high, which looked to me like a more-than-adequate test of its climbing ability. I started at the bottom from a dead stop and began my ascent. As it made its way up the hill, it threw loose sand 5 feet in the air, then quickly and effortlessly shot over the top.

The third obstacle was a boulder

(Continued on page 76)

The Starting Line

by Fred Fischer

Beginner's R/C Forum

This question/answer format is designed for beginners and will attempt to answer questions, correct misconceptions, and generally ease entry into the rapidly growing hobby/sport of R/C cars. We welcome your questions, as answers to representative questions will help other beginners. Direct your questions to me, Fred Fischer, at *Model Airplane News,* 632 Danbury Rd., Wilton, CT 06829.

This column is but one source and we encourage you to contact your hobby dealer and manufacturers of R/C car products for specific information on items they offer.

And so to our first run on the track:

Q. What is radio control (R/C)?

A. Radio control is an electronic method of remote control. Basically, encoded signals are transmitted by a hand-held transmitter and are in turn decoded by a receiver some distance away. These transmitted signals are sent and recognized as some position of steering or speed rate in a vehicle. A full explanation of R/C is well beyond the scope of this column. R/C is used to control cars, airplanes, helicopters, boats, and even robots.

Q. How fast do radio control cars go?

A. The speed depends on car type and power. There are two power types, gas and electric. Electric-powered cars use rechargeable batteries and electric motors to reach speeds of 15 to 40 miles an hour. Gas cars use a single cylinder engine burning model engine fuel—a methanol-based fuel—and they are faster than electric cars.

Q. Do I need a license to operate a radio control system?

The Starting Line

A. No, licenses are no longer required.

Q. What kinds of cars are available?

A. The most popular type of car today is the 1/10-scale off-road electric car. Next is probably the 1/12-scale track racers, followed by 1/10-scale off-road gas cars, 1/8-scale track racers and 1/8-scale off-road cars.

Q. What is meant by scale (1/10, 1/8, etc.)?

A. Scale gives a model's relative size to a full-size car; 1/10 means a model is 10 times smaller than its full-size counterpart. The Fast Attack Vehicle (FAV) being tested by the U.S. Army is a modified dune buggy. MRC-Tamiya has an R/C version of it in 1/10-scale. FAV has a wheelbase of 100 inches in full-size and the R/C version has a wheelbase of 10 inches. The 1/12-scale cars are slightly smaller than 1/10-scale cars, while 1/8-scale cars are slightly larger. Typically, larger cars are somewhat more expensive; depending, of course, on special features included in each kit.

Q. What kind of car should I buy?

A. You must first decide on your own favored style: dune buggy, high-speed sports car, off-road trucks—virtually every style is available in kitted form. The next decision is based on where you can run your car. You will need a very flat, clear, and smooth place to run track-style sports cars—paved parking areas, industrial parks, school yards, gymnasiums or tracks operated by hobby shops or clubs. If no such place is nearby, you might wish to start with a dune buggy, off-road vehicle, four-wheel drive truck, tractor, or even a military tank—all can operate on relatively rough surfaces, even your lawn or backyard.

Q. What kind of radio control system should I buy?

A. Check the manufacturer's recommendation for your car and then use good shopping sense to buy a system, one which will get you the best price and service. A two-channel, two-stick system is most popular. Each channel provides a separate control function, with a two-channel system giving steering and speed control. With two sticks on the transmitter face, the right stick usually is used for steering while the left stick controls throttle. Most electric cars have forward and reverse; gas cars usually do not have reverse. A throttle stick can be used to control forward and reverse as well as speed. There are wheel control systems best suited for people interested in competitive racing. The wheel takes the steering stick's place for finer control and is often more expensive with features useless to beginners.

Q. What other kinds of accessories will I need to build and operate an R/C car?

A. My recommendations are the following items: a modeler's tool set, model paint and supplies, a tool box for tools and spare parts and some items such as a soldering iron with electrical solder, electrical tape and the appropriate glues recommended by the kit manufacturer. In many cases, the kit manufacturer will give a list of tools for each car's assembly.

Q. What are the advantages of electric cars versus gas cars?

A. Electric cars are cleaner and quieter to operate since they use rechargeable nickel-cadmium batteries and electric motors for power. The electric car often has forward and reverse speeds, and can operate in somewhat rougher terrain. However, support equipment, such as chargers for the batteries, can be expensive, and electric motors are subject to burn-out and cannot produce as much power as a gas engine. Gas cars are often faster and produce more hill-climbing and road-flattening power, but require model engine fuel and starting equipment. They also might not have reverse, are noisier, and need more periodic cleaning for continued good operation. At the present time, electric off-road cars are most popular because of their simple assembly and operation, and ability to run on driveways, dirt paths, and other rough surfaces. Gas cars have been around a long time, and I think that gas off-road cars in 1/10- and 1/8-scales will slowly rise in popularity.

Q. What is the cost of running an R/C car?

A. The cost depends upon the R/C system, the car kit, and the accessories you wish to purchase. A simple off-road car kit can cost as little as $65. A two-channel, two-stick system can cost anywhere from $40 to $90. Batteries and accessories can cost from $40 to $80. I'm quoting these prices based upon beginner equipment. Your favorite R/C hobby dealer can give you guidance in selecting the right equipment at the right price for your needs. Later on, you may need to purchase spare parts. Here is where "kit" cars have an advantage over "ready-built" cars. Since you built the kit, you will be able to fix the car; a ready-built car might require dealer or manufacturer service. Check this point out before you buy!

The discussions in this column will depend upon your questions about R/C cars. Write in and, while I cannot answer individual questions by mail, I will try to answer on these pages. I'll be looking forward to hearing from you soon!

MRC-Tamiya

HOTSHOT

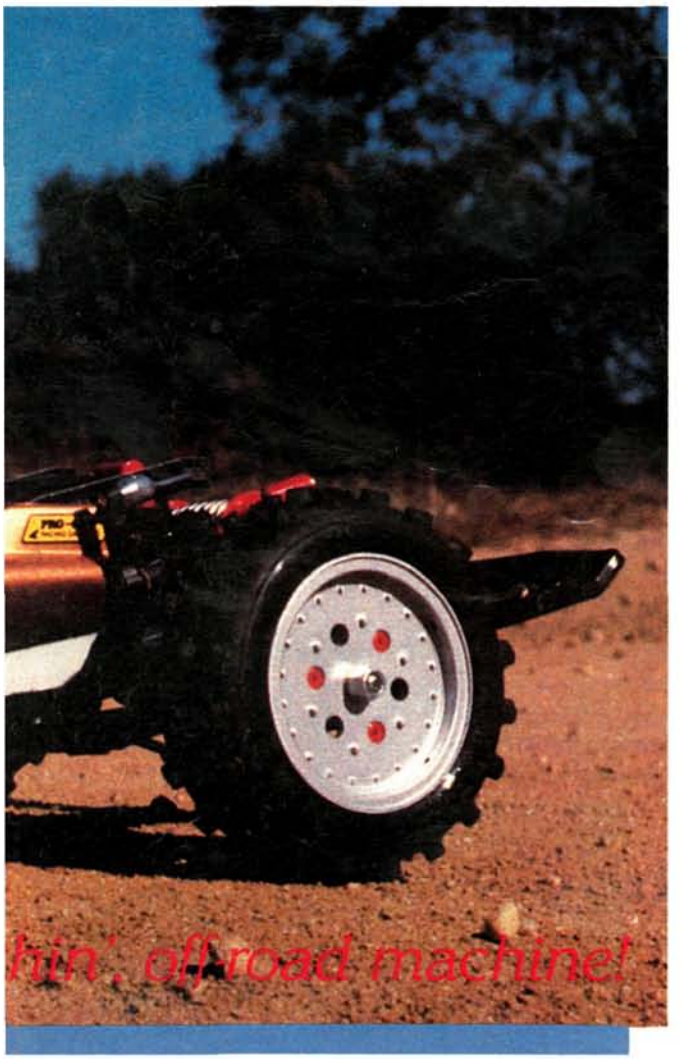
by Rich Uravitch

A rip-snortin', fire-

IF ONE PHASE of R/C modeling has ever experienced a dramatic rise in popularity over a short period of time, off-road racing would likely be it. I've never gotten seriously interested because I figured they were "two-dimensional"—you'd run them around in circles while varying the speed! So, no big deal, certainly not the thrill that comes from getting airborne! Well, that's only partially true, you sure *can* get airborne and the off-road capability injects its own equivalent "third dimension." Most of these things are designed to take nearly all the abuse anyone can dish out, and some of the more sophisticated versions even incorporate four-wheel drive.

My introduction to 4WD came by way of an excited call from Louis DeFrancesco Jr., our enthusiastic Associate Publisher, saying he had received the newest of the new, the penultimate in applied engineering, something he thought was really neat and felt even I could operate. Well, with an intro like that, I expected the long-rumored vertical takeoff Harrier with a pair of gimbaled Byro-Jets, an MRC PCM X2J391 18-channel radio, and an automatic invitation to the '85 Scale Masters to arrive within moments. What actually arrived was a bit smaller but ultimately provided the same kind of fun with a lot less work!

The Hotshot is the latest in the ever-expanding electric-powered R/C car line manufactured by Tamiya and marketed by MRC*. The whole R/C car scene, as previously mentioned, has enjoyed tremendous growth recently, due largely to the "no previous R/C experience required" method of entry. No building, finishing, or covering, and there are tons of support equipment. Just buy a kit, radio, battery pack, and charger, and you're in!



THE KIT. This review takes a slightly different approach than any of those I've written before—I didn't build the kit! I did study the assembly manual, marvel at the overall engineering and completeness of the kit, paint the body, and provide some technical assistance when necessary, but actual construction and testing was accomplished by my sister-in-law Carol Nail and my wife Maribet. My reason for this was two-fold: I had a limited amount of time before deadline; and Carol, while mechanically inclined, had never attempted *any* kit before which I hoped would allow her to give a more accurate evaluation of the kit and identify any assembly problems. Modelers with advanced levels of experience might tend to overlook difficulties, some of which could be frustrating to the novice.

CONSTRUCTION. Assembly was performed strictly "by the numbers" and consumed about 16 hours from start to finish. Not many tools were required; screw drivers, pliers, and an X-Acto knife pretty much cover it. Tamiya supplies wrenches, lubricants, and nearly everything else you'll need. The parts locator illustration at the rear portion of the assembly book identifies everything, including the parts not used. The only mislocated part we discovered was the Stabilizer Ball used in step 10. We found it in blister pack B rather than A—not too shabby, just one out of maybe 150 parts!

Among the really clever innovations is the use of oil-fitted "spring-over" adjustable shock absorbers on both front and rear suspensions. This feature allows you to fine tune the chassis to suit your running requirements.

The only painting required is to the clear polycarbonate body and rear wing assemblies. For those of you who were involved in the electric slot-car craze some years ago, the technique for painting these parts is the same—from the inside. This gives additional "depth" to the finish but, more importantly, makes it chip and scratch resistant. I also painted the wheels aluminum, but that was only a personal preference.

I would strongly recommend the use of the Acoms Technipulse two-channel radio for use in the Hotshot. I'm sure nearly any radio could be made to fit, but would probably require a bit more work and perhaps some modification, as the radio box is not huge. The installation is, however, well thought out and worked the first time.

One unusual aspect of the car is the use of a common power source for both the electric drive motor and the radio. This is clever in that it eliminates the need for a separate pack (which would be a problem due to space constraints) and provides a secondary back-up indication that the battery is nearly discharged, the steering servo goes to "right turn" and the car runs in slow circles until there's no power left—a kind of "fail safe!"

PERFORMANCE. Test runs were performed by Carol and Maribet, who, incidentally, offered great resistance to letting me try it. When I finally did get the transmitter away, I proceeded to thoroughly bash it about! The steering is very quick and responsive but not overly sensitive. The throttle comes on "right now," and with a little practice you can use the transition from forward to reverse as brakes. The whole setup is extremely rugged, the components super "beefy," and I seriously doubt you could break anything through even beyond normal use.

The consensus, among the three of us, was that this project was fun, both in assembly and running. We're still finding things to try with it. The girls suggested some racing—but I'll have to get my own car!

(Continued on page 81)

**The following is the address of the company mentioned in this article:*
Model Rectifier Corp., 2500 Woodbridge Ave., Edison, NJ 08818. ■

Mugen BULLDOG

This Samurai "rice burner" is cleaning up on the R/C circuit.

by Dan Landan

BEING the speed freak I purport to be (I've been involved in full-scale offshore powerboat, motocross, and drag bike racing for years), I'm always looking for new thrills. The first time I saw an off-road R/C car I thought to myself, "These are outrageous—I've got to have one!" So I subsequently dove headfirst into the R/C car scene.

The Mugen Bulldog, which is manufactured by Mugen Engineering of Japan and distributed by Varicom Industries*, is my newest effort. This latest rice-burner from our Funabashi friends incorporates some really neat innovative engineering.

It's a 1/10-scale four-wheel drive off-roader with independent suspension at each wheel, and the suspension is damped by adjustable air shocks at each end. This Samurai Bulldog is propelled atop even the roughest terrain by the ubiquitous Mabuchi RS540S electric motor, so popular among R/C enthusiasts. Radio transmission was supplied by the dependable 2-channel "Aerosport" radio marketed by Hobby Shack.

CONSTRUCTION. Construction was straightforward due to the well-illustrated instruction manual and simple yet efficient monocoque frame which houses the differential assemblies, motor pinion gear, and cog belts.

The first step is differential assembly, which was simple but time-consuming. Next is mainframe and side plate assembly and it should be noted that the instructions make reference to a metal housing (step 6), however this housing is plastic and should be installed with the shoulder on the inside of the plates. From here the rest of the main frame and side plates assemble with ease.

Next the suspension and servo bracketry are installed, also a simple affair.

After installing axle half shafts (step 21), I suggest you delay installation of the wheel stopper pin, as it will not stay in place until the wheels are installed. The rest of the car was quite simple and, because of the extremely well-illustrated instructions, a step-by-step treatise would only be redundant.

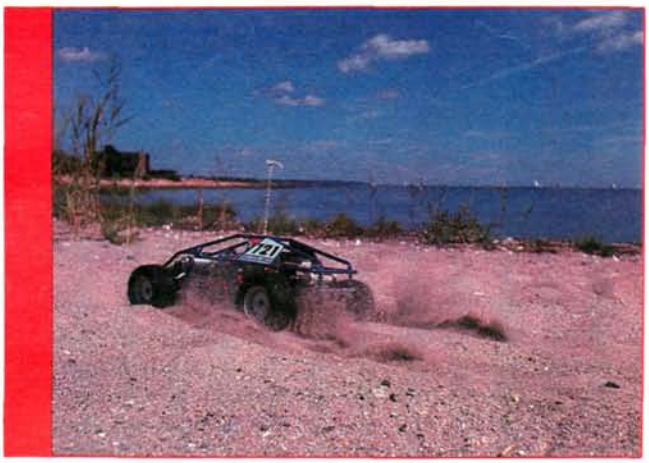
The only other mentionable problem was the servo horns. You must use the star-shaped servo horn that comes with the radio for the forward/reverse controller and the holes must be drilled larger to accommodate the controller rod.

Remember while assembling to secure all screws and nuts with a good adhesive. I found that Zap-Loc glue from Pacer* will work just as well, if not better, than Loctite. This prevents the vital parts from becoming susceptible to vibration and eventually coming apart.

After assembling the rest of the car, which took about 7 hours, it was time to paint the kamikaze driver. I used the new enamel paint markers from Tamiya*, which are truly the greatest invention since Polaroid film. You can work in tight places with no drip and they come in a tremendous variety of colors.

After some last minute fine-tuning and charging of the nickel cadmium battery pack with the high quality Leisure Electronics* charger, it was off to the roughs to cause chaos and put the now venerable Japanese Bulldog through the ringer.

PERFORMANCE. I first tested it on asphalt to test alignment of the four independently



The Mugen Bulldog is unquestionably an all-terrain vehicle; even heavy sand won't slow it down. Power by Mabuchi RS540S.

turning wheels. I found the steering to be quite sensitive and therefore it was necessary to change the front steering ratio from 3:1 to 1:1. I accomplished this by moving the main front steering linkage to the inner-most hole on the servo horn. After this the Mugen turned in a controllable, serpentine manner. Off-road performance proved to be outrageous. The Mugen is capable of dealing with the roughest of terrain and is virtually unstoppable.

Its "Bulldog" name is a most befitting one. With its low center of gravity, the Bulldog is very stable and when it takes flight off a jump, it usually lands on all fours. As for the other cars I was racing with, the Mugen literally drove over them when they obstructed its path. Come to think of it, the Bulldog is more like a frenzied pit bull!

It has been reported that the Mugen took first in the Western Off-road Championships and second in the World Championships (Stock Class), which leads me to believe that this Bulldog is quite a formidable competitor.

So, if you're looking for a dirt burner that can take some punishment and hang with the best of 'em, the Mugen is for you!

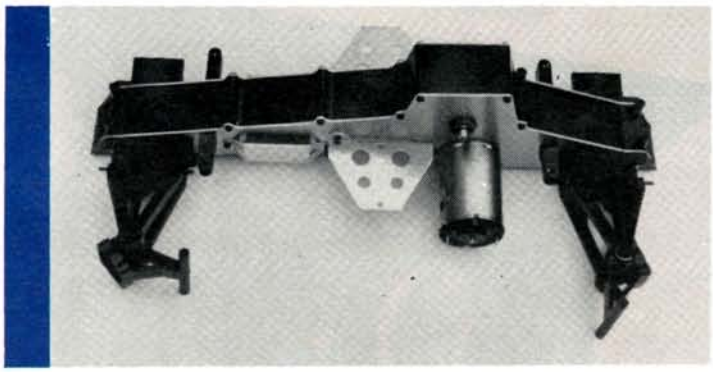
**The following are the addresses of the companies mentioned in this article:*

Varicom Industries, 18480 Bandilier Circle, Fountain Valley, CA 92728.

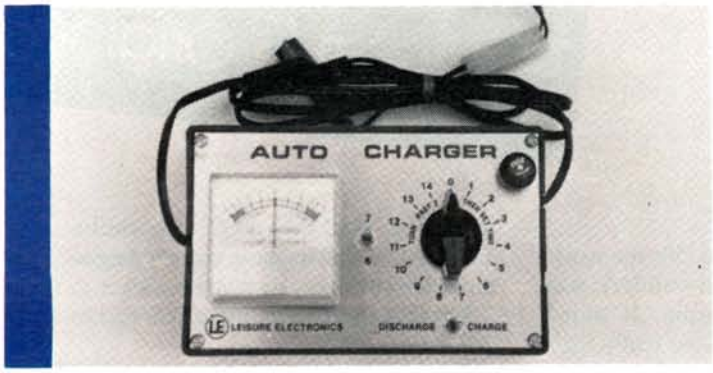
Pacer Technology and Resources, 1600 Dell Ave., Campbell, CA 95008.

MRC-Tamiya, 2500 Woodbridge Ave., Edison, NJ 08818.

Leisure Electronics, 11 Deerspring, Irvine, CA 92714. ■

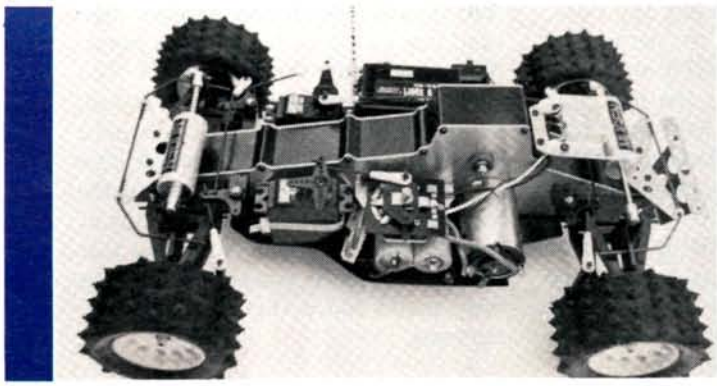


A full monocoque frame assembly provides full protection to all components, as well as a rigid mount for the individual suspensions.



Leisure Auto Charger handled recharging duties very effectively. Unit fast-charges safely and has a discharge function.

Hobby Shack's dependable and economical two-channel Aerosport radio proved to be a fine control unit.



Completed chassis assembly evidences fine mechanical design and practical features that permit the Bulldog to operate on rough roads at high speed.

'32 Highboy

The Original Hotrod

by Budd Davisson

IN THE 1940s and '50s the world of backyard hot-rodders was Southern California. It didn't matter that you were really from Ohio or New Jersey, if you were a hot-rodder, your heart lived in Southern California, where the sun always shined, the streets were wide, and the cars were fast. And they had no tops. And no fenders. Ditto, the engine hoods.

The hot rod was a roadster. It was that way in 1946 and today, 40 years later, the word "hot rod" still means one thing: a stripped-down Ford roadster with a chromed V-8 pulling air in through a couple of Stromberg 97 carburetors and pushing air out through rumbling dual exhausts.

But, the roadster isn't just any Ford. In its most classic form, the perfect hot rod started life as a 1932 Ford. Why 1932? Because that was the first year Henry put V-8s in his light little runabouts. It was the Ford flathead V-8 (the valves were in the block, rather than in the heads like all modern overhead valve engines, so they were "flatheads") that brought lots of cheap horsepower to the kid down the block. By the late 1940s and '50s, the old Ford roadsters were just that—old. But, they were also cheap. Twenty-five dollars gave you the beginnings for your very own street rocket.

But first there were things you had to do to it.

Fenders were the first things to go. They were heavy, and they slowed you down. Besides, the car made you look really "hep" if it had no fenders. Then the top went. But that was okay because, supposedly, it never rains in California (but what about Ohio or New Jersey?), and, besides, it was hep.

While you were busy taking things off the body, you were just as busy putting things on (and in) the engine. First you bored out the cylinders to take bigger pistons and installed a crankshaft that made those bigger pistons move a little farther. The "bored and stroked" flathead was the standard for heavy horsepower and brute low-end torque. You capped the block with a pair of finned, aluminum high compression heads and a special manifold that mounted at least two 2-barrel carburetors. Some of the really far-out machines ran as many as four carburetors! And everything that could be chromed was chromed. So, it only made sense that the hood be removed.

And then it was out to the dry lakes. Southern California ("SoCal" to the "in" group) had the best straight-line race tracks in the world. A million years ago they were lakes, but the hot-rodders found them to be perfectly flat areas that ran on forever. So, they'd measure off the distances and see who could run the fastest. And could they ever run! One-hundred-and-forty-five mph wasn't unusual and that was in a car that had been cruising the boulevards and picking up hotdogs at drive-ins the night before.

The term "highboy" wasn't used until they started channeling the cars. On a channeled car, they'd cut the floors loose around the edges, drop the body down over the frame, and weld the floor back in place. This made the car look lower even though the frame was still the same height. Those '32s that lost their fenders but still sat on top of the frame, rather than being channeled, were then called "highboys."

The '32 ("Deuce" to those who know) highboy roadster has always meant one thing—fun on wheels. The Deuce means warm summer evenings cruising along the ocean front, surf music on the radio, and the wind in your hair. The sound of the flathead burbles out behind you as

(Continued on page 54)

Track Report

Kyosho Vanning 4WD

One Wild Nitro Burner

By Steve Pond

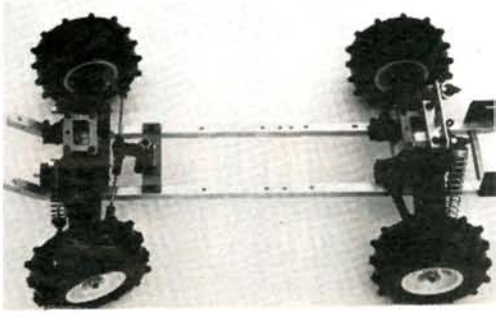
IN THE WORLD of R/C car racing, there are as many different types of cars as there are different types of terrain, and each type of terrain is best handled by a different type of car. In the category of off-road racing, cars are composed of strong frames, knobby tires, big shocks, and big engines. The Kyosho Vanning available from Tower Hobbies* is a perfect example of a tough off-road car equipped to handle rugged terrain.

THE KIT. This latest 1/8-scale entry from Kyosho incorporates such features as: sophisticated double-wishbone independent suspension on all four wheels, with four-wheel drive for maximum traction, and a race-proven square-section 17S aluminum alloy ladder frame. Coil springs with special oversized, oil-filled shock absorbers for top handling on even the roughest tracks are included, as well as a front suspension with compound caster upper wishbone angle plus kingpin angle for top directional stability after jumps. Special lightweight three-piece wheels, custom fuel tank, heavy-duty servo saver, and special high-grip knobby tires round out the package.

The Vanning also has features such as sealed ball bearings on all four wheels, oil-filled, limited-slip differentials, the simplicity and durability of chain drive, and the awesome stopping power of disk brakes.

Supplies you'll need to complete this kit are a .21 buggy engine (3.5cc), a two-channel radio system, and an exhaust manifold and muffler. There are also some tools you'll need that are not supplied with the kit: a Phillip's screw driver, a 5/16 nut driver, scissors, needle nose pliers, a good hobby knife such as an X-Acto, standard pliers, a good cyanoacrylate glue (I highly recommend Pacer's* Zap Lock and Plasti-Zap), masking tape, and a good flexible paint.

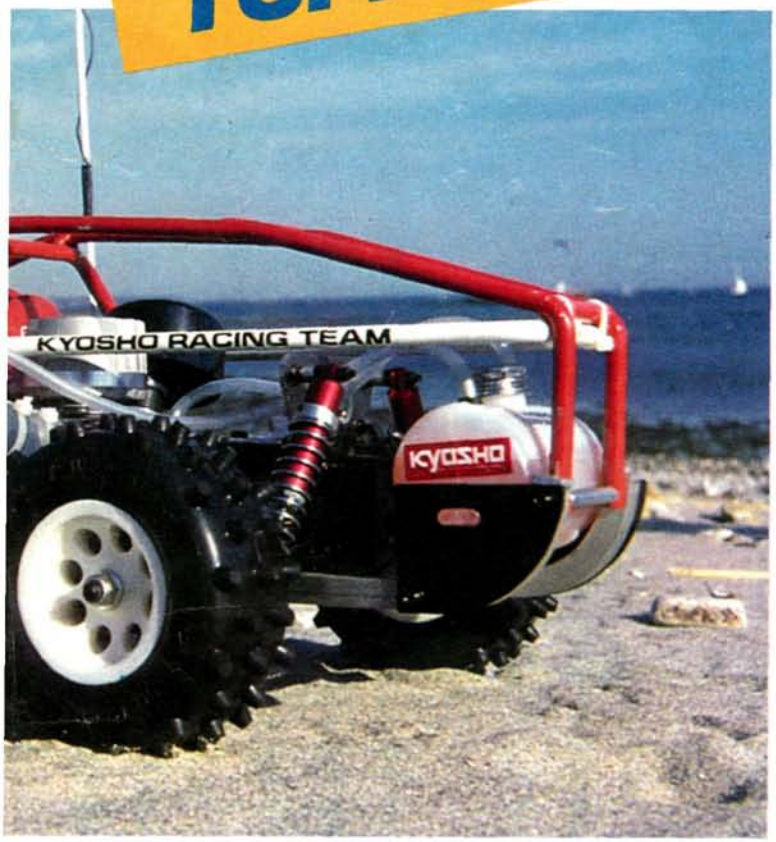
ASSEMBLY. The construction of the kit begins with the main chassis, which is comprised of two alloy frame rails connected with a joint collar in the rear and the steering assembly in front. It's very important to distinguish the left frame rail by an extra hole in the top for the motor mount. If you fail to do this, engine installation could prove to be very difficult. Next are the hub carriers and front dampers (shocks). Be sure there are gaskets on the damper stoppers. If you don't, the damper oil will leak out and cause damage to your shocks. After this, assemble the entire front suspension.

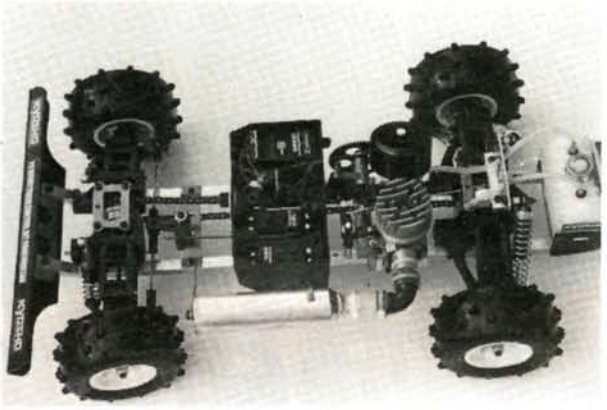


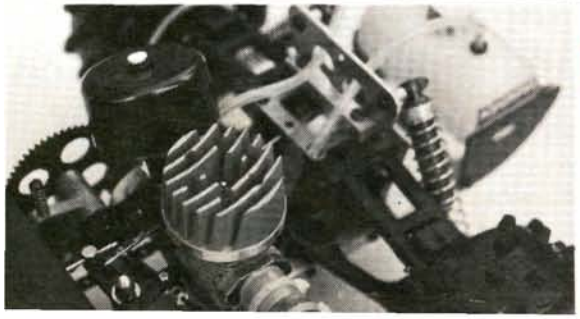
Kyosho employs aluminum alloy frame rails for lightness and strength.

TUFF STUFF!

photos by Louis V. DeFrancesco Jr.







The O.S. Max-21VF-B ABC engine proved to be a potent powerplant.

Before you install the suspension to the frame, place the differential between the bulkheads. Now bolt it to the frame. At this point skip to step 10 temporarily. Installation of axle joints will keep the bearings from falling out.

Next is the steering linkage, rear axle assembly, and brake caliper. This is followed by rear axle installation, and the construction of the rear suspension. Don't try to take apart the rear dampers, they are already filled with oil and tampering will only result in damage.

The next step is to place swing shafts or half shafts in place and install wheel shafts and bearings. After the spur gear mount and tensioner are completed, install them to the frame. The flywheel and clutch assembly are contingent on what type of engine you chose, so it's best to buy your engine when you purchase your car. When installing the clutch lining, don't cut it, as it will fit. Now connect the engine to the frame and install the chain. When connecting the chain with the master link, make sure the open end of the chain clip is facing opposite the rotation of the chain or it might cause it to pop off.

(Continued on page 29)

Track Report

Circus Hobbies

photos by Alan Palermo

Super Wheelie

by David Trost

WHEN I FIRST SAW the Super Wheelie cars advertised, I wondered how Circus Hobbies* could market an acceptable kit for such a great price. However, since I've been favorably impressed by all the Circus products I've used, I decided to give one of these cars a try.

THE KIT. The kit came encased in a 2x3-foot box, decorated with many drawings of the car in various positions. Upon opening the box, I was struck by the care taken in packing the parts. Every plastic tree was individually bagged, and the smaller metal parts were organized in several bags. The larger metal parts were encased in bubble plastic over cardboard.

The basic kits for the Super Wheelie cars include everything needed to complete the car except for basic tools, a 2-channel radio, and a 6-volt nickel-cadmium motor battery.

The Super Wheelie cars come in two body styles; a Jeep CJ and a Toyota Land Cruiser. I received the Land Cruiser and a Challenger 2P radio from Hi-Tec Aristo Craft for the review. I used a Circus Hobbies 5-cell nickel-cadmium battery in my car.

Both of the Super Wheelie kits feature independent front suspension, coil spring rear suspension, a working differential, and wheelie bars. The cars can be set up in two configurations, one for wheelie driving and one for normal driving.

Most of the construction is easy and straightforward. The instruction manual provided is quite good and very complete. Each page is headed by a list of the

metal parts needed in the construction steps on that page. The heading contains a full-size drawing and a description of each part. Each construction step is illustrated with a clear, accurate exploded-view diagram. Since most of the construction is so easy, there is no reason to repeat it all here. I'll just hit some of the high spots.

CONSTRUCTION. I started by installing the front suspension and the ball-link steering linkage on the main chassis. The model doesn't have ball bearings on the front wheels but the plastic bushings provided work very well. I was pleased to see that special plastic tools were provided to facilitate driving the front axles into the suspension arms. Other specialized tools were also included, making what would have been difficult construction steps, easy.

Rear axle assembly was next. The gear train is of heavy nylon and the rear axles and the idler gear shaft are bronze bushed. An RS-540S motor is used in this kit. No problems were encountered during construction until it was time to install the radio. Any standard radio with a square battery pack will work fine in this car. However, if the servo used on the speed controller has a bump on the top to accommodate the gear train, the controller will not fit as described in the instructions. The Aristo Craft HS-306 servo is just such a servo. The speed controller is mounted on the top of the servo with double-sided tape and if the servo doesn't have a flat top, the controller can't be positioned correctly. I partly solved the problem by cutting some of the metal away from the speed controller mounting plate, but I still couldn't get the alignment correct. This misalignment made it impossible to use the ball-link pushrod provided. Instead, I made a 1/16-inch wire pushrod with a Z-bend at the controller and a Du-Bro* easy connector at the servo. This pushrod was easy to set up and has worked well. No other problems were noted in the construction of the kit.

The chassis allows the radio and the motor battery to be installed in two ways. The motor battery can be placed low in between the wheels for stability or it can be placed high over the rear wheels so that the car wheelies almost all the time. The configuration can be changed at any time just by removing three rubber bands and swapping the motor battery with the radio receiver and battery.

I painted the body of my car with Testor's enamel and Tamiya* acrylic paints. The attention to detail in the body is impressive. The speedometer has all the speeds clearly marked, and the short-wave radio has a readable frequency on the dial. Construction was completed with a set of self-adhesive decals included in the kit.

The Hi-Tec Aristo Craft Challenger 2P from Polk's Modelcraft Hobbies* is a pistol grip, 2-channel radio. The system includes a transmitter, receiver, two HS-306 servos, a dry cell battery case with a switch, and an assortment of servo arms and servo mounting hardware. The transmitter is a rugged, well-balanced unit and feels very comfortable in the hand. It

(Continued on page 71)

CIRCUS 2 Winner SERIES

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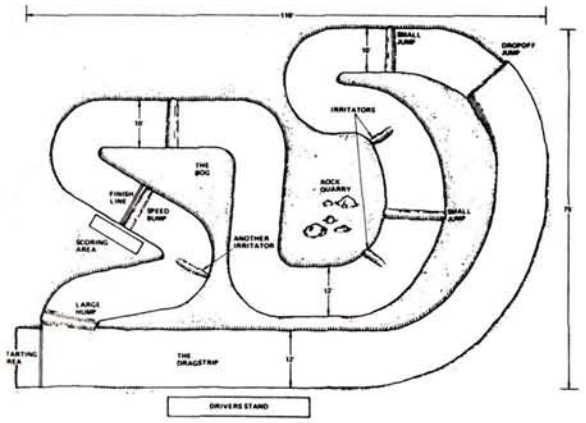
DEALER INQUIRIES INVITED

Race Track DESIGN

by Mike Lee



Some ideas to help you design your own neighborhood race track.

THERE HAS been no denying the fact that radio-controlled auto racing has been booming. In the last five years R/C car racing has surpassed slot car racing in popularity during its entire history. In 1984 over two million off-road cars were purchased by race enthusiasts in the United States alone.

It's a fact that R/C car racing is here to stay, but only if you have a place to race. The race track is the very hub of competition and a place to attain fame and fortune.

In R/C racing there are two types of race tracks: road race and off-road dirt tracks. Both types of tracks have distinct differences which I'll discuss. With this information, you can organize your own racing club and track.

Hard surface type tracks with multiple corners and turning hazards of varying difficulty are usually found in road racing. They may also feature small but very gentle rises or dips, and can accommodate 1/8- and 1/12-scale cars.

This type of course is normally constructed of asphalt or concrete. The surface is normally quite smooth, much more so than common asphalt. Concrete tracks are also smooth, but never to the point of being slick. Most tracks are found in parking lots of large building complexes and are used with the landlord's permission. This eliminates the astronomical cost of having a track made.

A road race track is laid out with painted lines to indicate the actual course. Tight corners and other places where racers are tempted to cheat are normally marked off by corner "dots." Dots are made from circular discs which have a slight curvature to them. Many tracks use plow discs from a local farmer's plow. Make sure that whatever you use for an anti-cheating device won't inflict undue damage to the race cars. The idea is to cause enough of an obstacle to discourage a cut corner without damaging the car.

Race Track DESIGN

Hobby Bench off-road raceway in Glendora, California. The dirt course is incorporated into a dirt oval track of R.O.A.R. dimensions.

The entire track is usually bordered by a wooden retaining wall. This wall should be high enough to effectively contain a car and keep it from injuring spectators. Constructed of light plywood or bender board, the wall is planted firmly in contact with the ground. Wood is preferred to metal or concrete for the retaining wall because it will give a little upon impact by a car, thus reducing damage to the car.

Many tracks define the road course with other items, such as artificial turf on the infield portion or different colored lines. All markers should be clearly visible to drivers.

Most road race tracks have hazards: the sweeper, the dogleg, the hairpin, and the straightaway are just a few. Each name represents the hazard's shape. A sweeper is normally a wide turn which is 180° or tighter. It can be slightly banked and is normally a fast turn. The dogleg turn is interesting in that it consists of a wide turn which gets narrow as the turn progresses. It traditionally turns more than 90° and is used to slow and string out traffic. A hairpin is the classic 180° turn and it is also used to help slow down traffic. It provides a good place for high-power vehicles to show their stuff. Hairpins are often seen as they require little space on a race course and can effectively lengthen the track.

All drivers sit on a platform called the drivers stand, from which they can maneuver their cars. It should be at least 5 feet above the track so all drivers can see the entire course. Safety rails should always be used and it's a good idea to include ramp access as well as a stairway.

The stand should be able to accommodate 30% more people than the maximum number of cars to be run for teammates and photographers. Officials may want to view the action from this position as well. Any roof should allow room for radio antennas.

Scoring officials should be placed on the part of the track where the cars are at their slowest. This makes it easier for them to indentify cars as they pass, particularly if the lap-counting system depends on counting the cars as they go by.

Note: There are scoring systems which are very sophisticated, such as the BoLink AMB system which uses an Apple computer.

An off-road track is easier to produce because almost any dirt lot can be turned into a race track. The hazards I mentioned before are still there, only there are more of them.

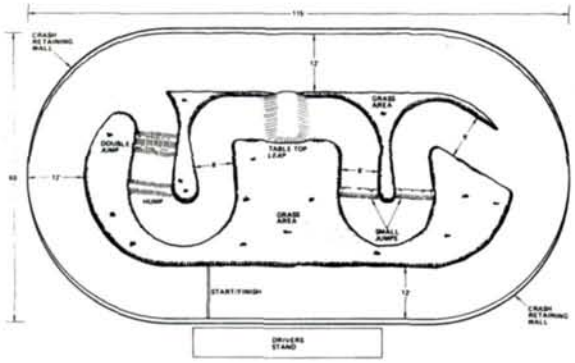
Like a road racing course, an off-road course is commonly a multiple-turn-with-hazards type. Oval racing is frequently incorporated into off-road courses. The track is still bounded by a retaining wall, only now the corners are protected by heaped dirt piles called "berms."

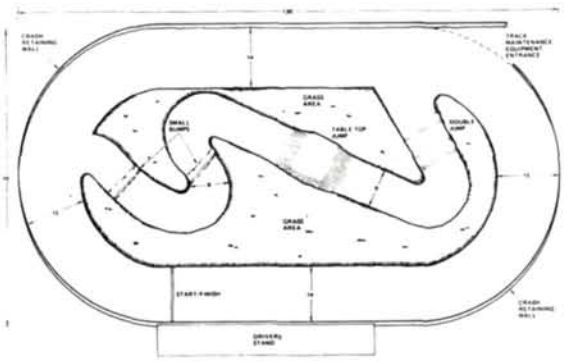
In an off-road course the soil used can have a great deal to do with the track's speed. According to Custom Racing Products, dirt tracks should have a soil content of 85% top

Ranch Pitstop off-road race course in Pomona, California, is a combination road and oval course.

An off-roadster leaps from a jump. Cars can suffer front-end damage with nose dives like this. Jumps should be designed to avoid punishing cars.

Coming down a long straightaway, an off-road vehicle is contained by high berms; outside berms are sharper than those inside.





soils, 10% clay, and 5% sand. The average vacant lot has a good deal of this stuff and so, with a little help from race fans and drivers, a track cut be cut from raw earth with hand-held garden tools in a matter of hours.

During a race session, dirt tracks should be watered lightly to keep dust from flying and to offer good traction. Mind you I said "lightly"; never enough to make mud. Excessive or insufficient watering should be avoided to keep conditions as even as possible for all drivers.

Berms are easily built by piling excess dirt from the track along the edges of the race course. A good watering job on the berms should settle the dirt and harden the berm enough to keep the cars from cheating. Berms should be higher around turns and hazards to help keep cars on the track.

Obstacles on an off-road course should be constructed from excess dirt as well. However, obstacles such as speed bumps, jumps, and whoop-de-doo's should not cause any damage to the cars trying to negotiate them. Jumps in particular should be constructed to allow cars to leap without sending them into an airborne tumbling motion. The majority of the cars should be able to make a jump and land on all fours consistently.

The size of your track depends on what type of car you will be racing on it. Off-road courses that incorporate oval racing events will have an overall length equal to the dimensions of the oval course. The off-road course is then run inside the oval with part of the oval track being used as well. This gives the track an overall length of about 130 feet, and a width of about 75 feet. Larger cars, such as 1/8 gas off-roaders, require track expansion of about 50%.

The asphalt burners are in the same ball park as far as track size goes. This is true at least for 1/12-scale electrics. For 1/8 gas it may be advisable to expand beyond the 50% mark in order to accommodate the high speeds that racers will attain.

These are just some of the basic ideas behind race track setup. Many tracks are designed to allow use in either direction to keep a driver's competitive skills high. Off-road tracks can be changed quickly and this should be done often to maintain a high level of driver interest. Road racing courses are not quite as versatile, but every effort should be made to change the track course at least once per season.

Hopefully you can take some of these ideas and make your own track. For more detailed rules on racing courses that meet national standards, contact the Radio Operated Auto Racing Club (R.O.A.R.). If your track is good, you too can hold a national level race. It's all for fun and racing, so give it a try. ■

MAGNUM FP-3PG

(Continued from page 18)

Below the exponential controls are two steering controls and a brake trimmer. On the left side is the left steering ATV (adjustable travel volume). This control allows independent control of the left turn without affecting neutral and the adjacent control allows independent right turn adjustment without affecting neutral. There are approximately 20° of movement with each one of these adjustments.

To the right of the ATV controls is the brake trimmer control. This control is used when you use brakes or brake with an electric motor, i.e., reverse the voltage on a resistor type speed controller. This control only operates when the trigger is in the "slow" or "brake" position. The throttle servo throw can be changed about 30° with this control.

Below and to the left of the steering wheel is the steering dual rate knob. This control can change the total throw of the steering servo from 45° either side of neutral to 18° by moving from left to right (counterclockwise). Above the steering wheel is its trim control. This allows neutral to be set accurately.

Moving over to the top right front of the transmitter, we find at top left the high throttle trim knob. This allows approximately 25% throw adjustment on the high throttle position when the trigger is held in the high position. This in no way affects the low-end throttle position.

Moving right, we find the warm-up switch, and this control is for engine-driven cars. The throttle warm-up circuitry automatically cycles the engine throttle servo between slow and high. When the warm-up switch is turned On (up), the throttle servo cycles between the operating positions set with warm-up throttle point trimmers at a period set at the warm-up time trimmer. At this time, the throttle trigger is disabled and the throttle servo is not operated with the throttle trigger. The front panel red LED lamp flashes to indicate that warm-up is being performed. When the warm-up switch is Off, the throttle trigger is returned to normal operation.

Three trim controls are located on the back of the transmitter. Trimmer A and Trimmer B set the total stroke of the throttle servo. A third control sets the cycle period adjustable from 0.7 to 1.6 seconds. With the warm-up switch On, the engine will automatically be cycled between the high and low limits at the period selected by the warm-up timer.

Below the warm-up switch is the level meter. When the transmitter is on, the pointer should fall in the silver zone. If it falls in the red zone, a charge or battery change is required. To the right of the level meter is the warm-up lamp previously described and to its right, the power On/Off switch—up is On.

On top of the transmitter is a loaded antenna measuring 40 inches, made up of nine telescoping sections. It will lock in the vertical position as well as at 30° right of vertical. The antenna may also be folded flush to the transmitter top.

Two other controls, which are not readily apparent, are the wheel angle adjuster and the wheel tension adjuster. These can be seen by tipping the transmitter forward and looking under the steering wheel. The wheel tension adjuster is located to the right. Use a Phillips screw driver to adjust drag. Clockwise is more, counterclockwise is less. The wheel angle adjuster thumb wheel can change the total operating angle of the wheel from a maximum of 38° either side of center to 30° either side of center. Turn counterclockwise for maximum throw.

At the bottom of the transmitter is the battery pack. This unit can be mounted as an integral part of the transmitter or it can be removed and carried in a pocket by means of an optional curled battery cord (Futaba Part FTA-2). If you want this option, take care to cover the contacts to prevent shorting the battery pack in your pocket.

On the back side of the transmitter I've already discussed the three controls associated with engine warm-up. In addition, there is a brake limit trimmer which allows control of the throw to be changed on the brake side of the throttle servo. In addition, the swivel grip setscrew is also located on the rear side of the transmitter, just below the RF module. Loosen the screw with a Phillips screw driver and you'll find that you can swivel the pistol grip up to 300°. Thus, you can find the most convenient position for you. This is a great feature if you are left-handed.

The last item on the rear side of the transmitter is the RF module. This can be removed by squeezing the tabs on either side and pulling the module out. Futaba 27 MHz and 75 MHz modules are interchangeable in the Futaba FP-T3PG system, but remember you must also change the antenna when changing from 27 MHz to 75 MHz or vice versa. Futaba part number for the 27 MHz antenna is type S91154 and for 76 MHz is type S91155. The RF module must be removed to obtain access to the three servo-reversing switches. They are clearly marked with the "up" position for normal and the "down" position for reverse. A metal eye is also provided adjacent to the RF module position to hook and hand strap for holding the transmitter.

In summary, the Futaba Magnum has many desirable features, most significant of which are the swivel grip, dual rates, and exponential controls. I have just finished an electric car and I couldn't resist the temptation to run the Futaba. I found the dual rates and exponential controls easier to learn when driving slowly, but because I was driving on a flat parking lot, it didn't take long to get my Porsche up to full speed. I haven't built an engine-powered off-road racer yet, but I can already recognize the advantage of the Magnum automatic throttle warm-up cycler. All in all, this was a very interesting radio to review with many fine features. Try it, you'll like it!

If you have any questions, drop me a line and I'll do my best to answer them. See you next issue.

Charlie Kenney, *R/C Car Action*, 632 Danbury Rd., Wilton, CT 06897.

**The following is the address of the company mentioned in the article:*

Futaba Corporation of America, 555 West Victoria St., Compton, CA 90220. ■

'32 HIGHBOY

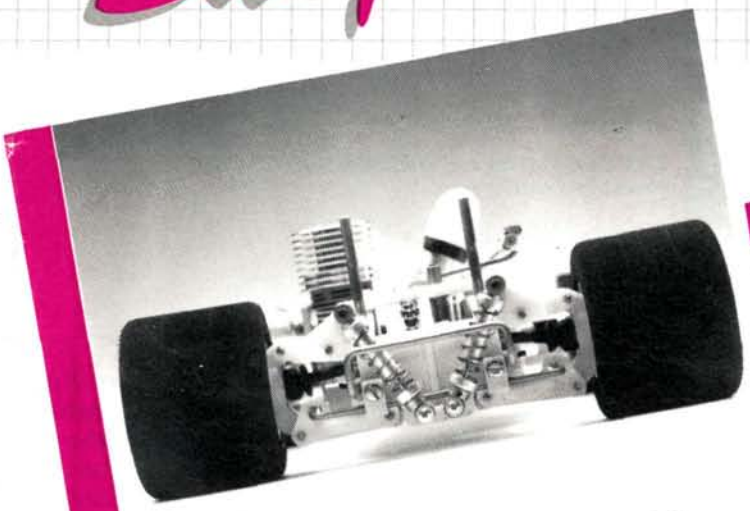
(Continued from page 40)

the dual exhausts talk to each other. You pull up to a stoplight alongside a stranger in his hot, new sedan and he turns to look. For a split second, his eyes catch yours and a slight smile tugs at the corners of his lips, as if challenging you. Then his eyes travel over the rest of your roadster, coming to rest on the gleaming engine in the exposed engine compartment. And the smile disappears. You prod the engine slightly with the accelerator, making the duals talk a little louder, and the guy in the sedan signals

(Continued on page 71)

Suspension Systems

by Mike Lee



Sophisticated rear suspension on Associated's RC500 gas road racer; independent rear suspension with all four shocks.

Typical rear independent suspension with trailing arm and oil dampener; Cox Scorpian.

Cox Scorpion front suspension. Note trailing arm type suspension that has become an industry standard.

IN THE SPORT of R/C car racing, there is one element of every car that must be near perfection to reach the winner's circle—the car's suspension. No one part of any car can make up for a mediocre suspension system. A proper understanding of suspensions can allow you to fine-tune your favorite race car and make it that much easier to win the gold.

With several types of race vehicles and racing classes available now, there are many different types of suspension systems. No matter, the object of suspension remains the same—to keep the tires in firm contact with the road surface. No amount of skill or prayer will make up for a car that can't keep its tires on the ground. Let's see what we have in suspensions.

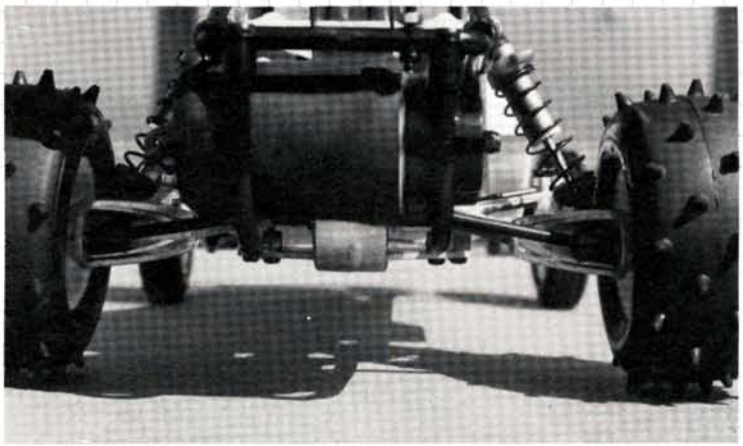
When R/C racing began some 15 years ago, race cars had a simple pan chassis and no suspension. Their handling qualities came from tires alone. Although sponge type tires were used, cars just couldn't keep up with the speeds and a loss of corner control frequently happened.

Today we have sophisticated suspensions that rival full-scale car systems, both in appearance and in function. It is not unusual to find that every car at a track has some sort of oil-filled shock dampeners, torsion bars, or springs on the suspension to optimize handling.

The most popular suspension system item is probably the oil-filled shock dampener. More commonly called "shocks," the oil-filled dampener is worth more than its weight in gold when it comes to doing its job.

Basically shocks are composed of a piston, a rod, and an outer casing. The piston is designed to allow slow passage of oil when the rod forces the piston to move within the casing. This slow passage of oil allows severe shocking movements to be absorbed by the oil. Gradual slowing of the piston

Suspension Systems



Cox Scorpion rear-end unloaded. Note oil-filled shocks and trailing arm.

and rod movement results and, because of this, smooths out shock severity. Sounds simple, yet it took years to accomplish effectively.

Ideally, shocks are mounted directly to the chassis suspension arm. Since suspension arms are the parts that initially receive any movement from a bump, it is natural to cut off any shock by placing the dampener as close as possible to road irregularities. This keeps bump vibration from reaching other parts of the car. Not only does this make for a smoother ride, but it also keeps the tires in contact with the road.

Other favorable side effects come from a good oil dampener and include radio gear protection, protection of the chassis from abuse, and overall good handling.

Another common way of mounting oil dampeners is to mount a single oil dampener in between two pivoting suspension arms. This is known as a mono-shock type suspension. It is found in both road racing and off-road racing vehicles. Its main advantage is its lighter weight and slightly less number of moving parts. This type of suspension must be very free to move in order to work well. If any part of a mono-shock suspension setup begins to hang-up, it will favor one side of the car more than the other. This results in a car that may corner well in one direction only.

Servicing an oil-filled dampener is really quite easy. Most dampeners are supplied in car kits with a lightweight oil. While this oil may be perfectly suited for some fast tracks, it may not be suitable for tracks that have many obstacles or with unusually rough surfaces. A mere change in oil weight (viscosity) will change the dampening rate.

If your off-road car bottoms out often even with the springs set to the strongest rate, the dampener oil is probably too light and you should replace the oil with a heavier weight. If the new oil's weight is sufficient, chassis bottoming should stop. Similar situations in road race cars are cured in a similar way. However, in a road race car, you should watch for a car's inability to level itself quickly when it runs over a bump. This would be indicative of too heavy an oil and too stiff a rate of dampening.

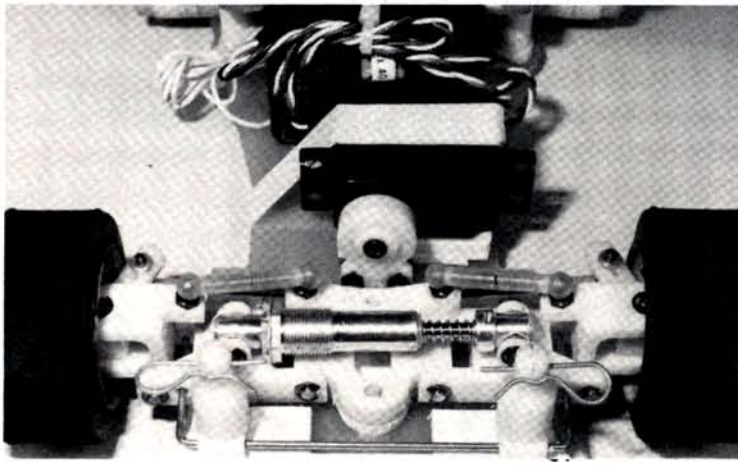
In any of the above cases, the rate of dampening should be that happy medium where the car neither rebounds like a rubber ball, nor sticks like glue and takes several seconds to recover to level. The car should be able to absorb a reasonable bump and recover back to level without allowing the wheels to leave the ground.

R/C car suspensions are comprised of other items besides just shocks. A most common item is the spring coil-over, normally seen on most shocks and used to either suspend the car entirely or partially while resting on its suspension arms. Some cars have separate springs and use coil-overs to assist the main springs. In any case, coil-overs are there to help prevent a car from completely bottoming or topping out of the suspension arm movement.

Maintenance on the spring coil-over is usually nil, as there is really nothing a mechanic can do to change the way they work. However, spring tension can be changed and this is what to work on when tuning your car for each track.

Generally, coil-over tension is increased for tracks with rougher terrain, and decreased for smoother tracks. The idea here is to keep the car from bottoming out, yet stay in contact with the road surface. Getting to sound pretty repititious I know, but contact's the name of the game.

Cox Scorpion front-end under load. Note front tires maintain a near perpendicular angle to ground under maximum flex.



Close-up shot of Associated RC12i front-end suspension; fully-articulated suspension arms with mono-shock suspension.

Another commonly used suspension component is the torque rod, or anti-roll bar. This simple device is designed to help fight a car's tendency to roll over in a turn. As the car begins to lean away from its turn direction, the torque rod applies pressure to the inside wheel and keeps road contact. The car remains flatter and is able to negotiate the turn faster.

As with a coil-over spring, nothing can be done to a torque rod to change the way it works. But rod thickness can be changed to acquire more or less roll compensation. By the way, this same rod can be utilized on rear as well as front suspensions.

In our road racing cousins, there are all these marvelous items we just talked about. And then there is less! In the case of a smooth race track with plenty of bite, less is better.

Many road race vehicles use no more of a suspension system than a plate mounted above the chassis, which is rather loosely mounted and holds radio gear. This plate is called a shaker plate and it provides all the suspension needed for many $^{1}/_{12}$-scale race cars.

The car does have a bit more to it than that; the chassis is of flexible fiberglass and is designed to absorb much road abuse. A shaker plate allows additional flexing in just the right places, and provides, to a marked degree, improved handling.

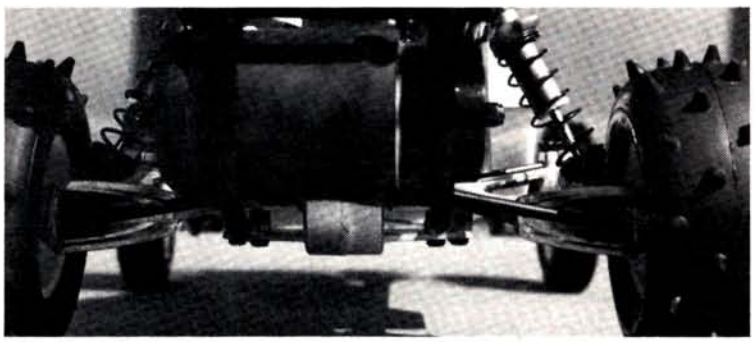
So why is this setup better on the smooth track? Simply because a more sophisticated suspension means weight. As in aircraft, weight equals drag, and drag means use of more power to push a vehicle down the track. As it is, our electric road racer is already weighted down with four to six heavy batteries, a ferrite motor, and radio gear. If you were to add a few more ounces of weight in oil-filled shocks, suspension arms to use them with, torque rods, tie-rods, and all the other necessary rot, you end up with a car that handles great, but can't punch its way out of a wet paper towel.

The trade-off with a less sophisticated suspension is a car that can go faster, last longer, and handling, if it's well set up, that doesn't suffer. Believe me, when it's down to the last few laps and the competition is hot, having a bit more punch than the next guy could mean a lot!

Maintenance of any suspension system requires constant attention. Because our cars are so close to the ground, and in constant contact, it is important to insure that all suspension moving parts remain free of dirt, dust, and grime. These buggers can cause a suspension arm to hang-up and render your fine-tuning useless.

Oil-filled shocks should be checked often for leaks, cylinder air bubbles, faulty seals, and bent piston rods. The shock should resist quick and sudden movement. If it does not offer any resistance, then it cannot be soaking up bumps and jumps as designed. Check these out daily and watch for any type of trouble. A blown shock could ruin the whole chassis.

There are many ways to test out your suspension system. Everything from drop tests to sliding the car across a carpet has been used. But the one goal to achieve is constant tire contact with the road. Tune the suspension until it suits your style of driving, then maintain it to keep it that way. Proper suspension tuning and maintenance can not only make a car last many times longer, but it can also put you in the winner's circle more often. And remember, KEEP THE TIRES IN CONTACT WITH THE ROAD—ALWAYS! ■



Cox Scorpion rear-end under load, tires change their camber geometry to maintain stability and absorb impact. Compare to upper left photo.

Engine Review

O.S. MAX-21 VF-R

by Peter Chinn

SPECIFICATIONS

Type: Air-cooled, single-cylinder, rear-exhaust, two-stroke-cycle with crankshaft rotary-valve and Schnuerle scavenging
Bore: 16.6 mm (0.6535 in.)
Stroke: 16.0 mm (0.6299 in.)
Displacement: 3.463cc (0.2113 cu in.)
Nominal Compression Ratio (full stroke): 12.5:1
Speed Control: O.S. Type 2S slide-throttle carburetor with adjustable automatic mixture control
Checked Weights: 303 grams (10.7 oz)
Mounting Dimensions:
Crankcase width: 30 mm
Length from driver face inc. exhaust adaptor: 94 mm
Height above CL: 74.2 mm
Bolt hole spacing: 38 x 15 mm
Manufacturer's Claimed Power Output: 1.5 bhp at 29,500 rpm
Manufacturer: O.S. Engine Mfg. Co. Ltd., Higashisumiyoshi-ku, Osaka 546, Japan
U.S. Distributor: Great Planes Model Distributors, P.O. Box 4021, Champaign, IL 61820

OF LATE, the international model car racing scene has been pretty well dominated by Italian engines and by OPS in particular. It was no surprise to discover that, in this year's World Championships for one-eighth scale track racing cars, eight of the first ten cars home, including that of the winner, Dutchman Rody Roem, were powered by OPS engines. What *was* surprising was that the second place car (a car that had actually led the race until delayed by running out of fuel on the far side of the circuit) was powered by one of the recently announced O.S. Max-21VF-R engines.

The Max-21VF-R is one of four 3.5cc class car engines currently manufactured by O.S. and supersedes the 21VF-C model dealt with in the May 1983 issue of *M.A.N.* The other three models consist of a rear exhaust off-road (buggy) engine, the 21VF-B (see *M.A.N.* February 1985) and two side exhaust models, the 21SF-R circuit car engine and the 21FSR-B buggy engine.

Although all these models share certain family characteristics, the differences between them go far beyond just the type of cylinder-head or carburetor used. Thus, the only major component that the new Max-21VF-R shares with the 21VF-B is its crankcase casting. Its front housing, crankshaft, piston/cylinder-liner assembly, connecting-rod and backplate, as well as its head and carburetor, are all new.

The most obvious change, compared with previous O.S. car engines, is the adoption of a slide-throttle type carburetor. Known as the Type 2S, this has a pressure cast aluminum body into which is inserted a hard-coated 13 mm o.d. aluminum alloy throttle barrel with fixed secondary needle and a rubber bellows dust cover. Screwed into the opposite side of the body is a brass mixture control valve which can be adjusted to vary the amount of fuel admitted at idling speeds. Fuel is metered, in the first instance, by a needle-valve assembly mounted in an angled boss in the carb body above the mixture control valve. O-rings are fitted to both the mixture control valve and the needle-valve to prevent air or fuel leaks that could upset mixture strength. Finally, there is a horizontal spring-loaded throttle stop screw for setting the idling speed.

This carburetor has a very much larger choke area than previous O.S. car type carburetors. The throttle barrel has a 9 mm i.d. throat and an effective choke area, at full throttle, of approximately 54

sq mm compared with 38 sq mm for the Type 2R and Type 2K carbs.

The emphasis on free breathing is also evident in the rotary-valve design. The valve timing (35 degrees ABDC to 64 degrees ATDC—during which time the intake port is fully uncovered for 42 degrees of crank angle) is the same as for the 21VF-B, as is the 8.7 mm crankshaft bore, but the valve port length has been increased from 12 mm to 13 mm and, more important, the entry from the port to the shaft bore is part-spherical to smooth gas flow. This, together with a deeper backplate and a reduction in the length of the crankpin, also reduces effective crankcase volume, thereby raising primary compression for improved pumping efficiency.

The 21VF-R is, of course, of the ABC type, using O.S.'s special ultra-hard, low-friction electroless nickel-based composite plating over a thick-walled (1.9 mm) brass cylinder liner. Cylinder porting has been somewhat modified. The unbridged exhaust port is fractionally wider and is open for a slightly longer period (172 degrees of crank angle). The two Schnuerle ports (open for 132 degrees of crank rotation) are slightly smaller, but are now inclined upward as well as being angled toward the front of the cylinder. The two "third" ports (128 degrees) diametrically opposite the exhaust, are also smaller. The reduction in inlet port areas is probably a reflection of the increased crankcase compression.

A new pressure cast cylinder head with the usual bowl and squishband combustion chamber shape is used. The conrod is, of course, bronze bushed at both ends. The heavily counterbalanced crankshaft remains at 12 mm o.d. but has a new inner ball bearing with a non-metallic retainer. The whole engine is beautifully finished and has an impressively silky feel when turned over. ■

Design and construction follows familiar O.S. pattern, however all major parts are new or modified.

New Type 2S carburetor parts, new crankshaft with gas-flowed valve port, front housing.

'32 Deuce

An incredible ¼-scale R/C model of the famed '32 Ford hot rod, powered by a fully operational supercharged mini V-8 engine!

by
Louis
DeFrancesco, Jr.

SPECIFICATIONS

Type: *'32 Ford*
Style: *Coupe*
Scale: *1/4*
Length: *39 inches*
Wheelbase: *Rear 19 inches; front 14 inches*
Height: *13 inches*
Channels: *6*
Radio: *Pro-Line*
Brakes: *Four-wheel disc*
Suspension: *Front—dropped axle with radius rods; rear—coil-over with oil-filled shocks*
Body: *Fiberglass*
Paint: *Black epoxy*
Total Weight: *35 pounds*
Engine:
Type: *Overhead valve Chevy V-8 (small block) with supercharger*
Scale: *1/4*
Displacement: *1.53 cubic inches*
Length: *5 inches*
Width: *4 inches*
Height: *7 inches*
Bore: *.625 inch*
Stroke: *.625 inch*
Compression: *10.5:1*
Horsepower: *4 bhp with supercharger*
RPM: *2-12,000*
Cooling: *Internal water-cooled*

IMMORTALIZED by the Beach Boys and sought after by hot rod enthusiasts for over three decades, the '32 Ford Coupe, better known as the "Deuce," is the stuff automotive legends are made of.

I was bitten by the hot rod bug at the age of fourteen and by the age of fifteen I bought my first car, a classic '57 Chevy Bel-Air Coupe for $175. One-and-a-half years, $3,000 (a lot of money for a sixteen-year-old in '71), and 427 fire-breathin' cubic inches of Chevy power later, I had the ultimate street machine. It was the beginning of what would be years of hot rod building.

Gary Conley of Illinois was also bitten by the hot rod bug at a tender age and he is still active in hot-rodding today. His latest creation is a supercharged V-8-powered '32 Ford Deuce Coupe. It features all types of goodies, including a dropped axle, a three-speed transmission, a fiberglass body, a roll and pleat interior, headers, disc brakes, plenty of chrome, and much more. Sound like a candidate for the street rod nationals? Yes, if it were full-scale! Gary's '32 is a ¼-scale radio-control model that actually runs. From the miniature super-charged V-8 to the three-speed transmission, it's your wildest model dream!

And can this little asphalt-burner run. With 4 hp at 12,000 rpm, it can reach about 60 mph—all under complete control, of course, by the use of an R/C transmitter.

It took Gary about one year to finish the car and it is completely hand-built. He machined all the parts himself.

The attention to detail is astounding, especially in the car's working systems, i.e., disc brakes, supercharger, water-pump cooling, knock-off wheels, ring and pinion differential, electric starter—the list is seemingly endless.

I saw the car recently at the Chicago Model & Hobby Expo and, judging by the crowd's response, it was the hit of the show. Gary has been offered over $10,000, but he's not budging. "I've just got too many hours into it," he says. "It just wouldn't be worth it to sell it."

Gary is the living embodiment of perseverance and ingenuity. If you've got them, you can build just about anything.

Oh, by the way, Gary is now designing model four-stroke airplane engines for K&B Manufacturing and I'm sure you'll be hearing more about him and his engines soon! ■

Track Report

Parma Euro Panthe

A dynamite 1/12-scale racer with Le Mans performance—now a world champ

By Steve Pond

I HAVE always been infatuated with European endurance and Can Am racers, so I jumped at the chance when the publishers of *Radio Control Car Action* asked me to review the latest from Parma*, the Euro Panther.

THE KIT. The Euro Panther is an extremely lightweight 1/12 electric racer which includes a Lexan body, aluminum rear body, graphite axle, flexible chassis, a powerful

Radio transmission was supplied by the state-of-the-art Futaba Magnum radio.

Renault motor, extra wide tires, and adjustable body mounts. Parma sent me the deluxe kit, which included more goodies such as a rear anti-roll bar, computer-matched batteries (Sanyo), rear axle ball bearings, rear body wing, ball link steering, and an ultra-light speed controller.

ASSEMBLY. It would be overkill to go into a treatise on building. The Euro Panther is so easy to assemble that any beginner could tackle it in a matter of 4 or 5 hours, so I'll just touch on a few points.

The front end was first and it is recommended that you polish the king pins with fine sandpaper or steel wool for smooth steering action. Don't forget to grease the king pins before installing steering blocks.

Next was the rear pod assembly and I recommend that you use ball bearings on the rear axle to prevent premature wear. It is also imperative that you lube the differential before assembly. Chassis construction was a breeze, just a matter of two bolts. Radio and battery installation was next. I used a state-of-the-art Futaba* Magnum radio with FP-S132H servos, held in place with two-sided tape, but it would be prudent to secure them with strong nylon tape.

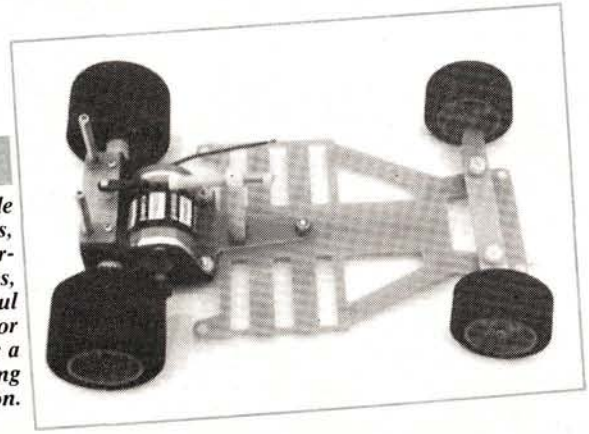
Finishing the body was the last step and I used the polycarbonate paint offered by MRC* which is fantastic for painting Lexan bodies. Don't use enamels or lacquer paints, as they'll crack. There are all types of decals available and I chose Autographics. The sky's the limit when painting and detailing, and there are all types of magazines and books available showing full-scale Le Mans, Can Am, and Grand Prix race cars.

TRACK TEST. Now for the fun part! I anticipated nothing less than hot performance since the Euro Panther, driven by Bud Bartos, took first at the World Championships in stock class. So, after charging the batteries with Texxon's* new variable AC/DC auto charger—which is by far the most powerful charger I've tested to date—it was off to my favorite parking lot.

The Euro Panther is a great carpet racer, but you'll probably have more fun running it on a smooth parking lot. The acceleration and handling were quite impressive, and the car is downright fast. It was difficult to spin because of its low center of gravity and ample tires. Each charge lasted about 12 minutes, but an overweight throttle finger might shave a minute or two off this.

The Euro Panther is also quite durable, as evidenced by our altercations with the cement curbs. After about an hour of abuse, no adjustments were needed—a true testament to its durability.

In summary, this is one neat 1/12 scaler that's not only simple to build, but packs a lot of performance and durability. It's an excellent choice for any R/C car buff!



Flexible chassis, computer-matched tires, and powerful Renault motor make for a winning combination.

**The following are addresses of companies mentioned:*

Parma International, Inc., 13927 C Progress Pky., N. Royalton, OH 44133.

Futaba, 555 W. Victoria St., Compton, CA 90220.

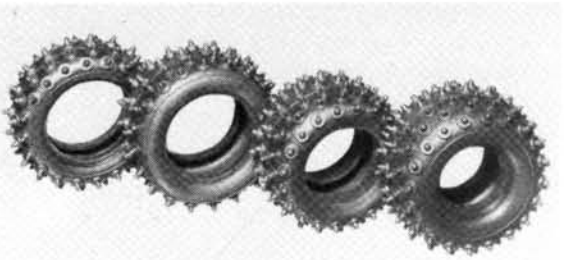
MRC, 2500 Woodbridge Ave., Edison, NJ 08817.

Texxon Prec. Prod., P.O. Box 420496, Miami, FL 33242. ■

42.

What's New

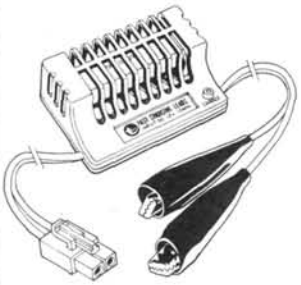
GATOR OFF-ROAD RACER: The Circus Hobbies (3132 S. Highland Dr., Las Vegas, NV 89109; 702-732-0022) Gator is a 1/10-scale, electric off-road racer and features independent suspension, differential gear, in-board mounted springs and shock absorbers, and a powerful electric motor. All you need are nickel-cadmium batteries and a two-channel radio. You'll leave 'em in the dust with this versatile car.

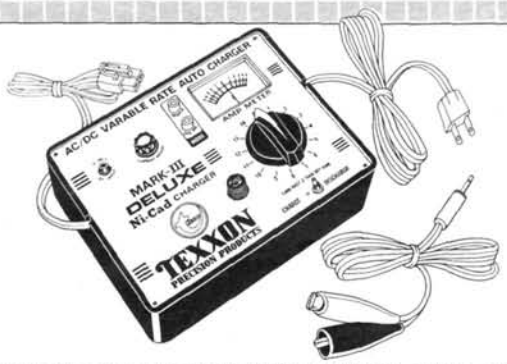


CRP DYNAMITE TIRES: Direct replacement buggy-spiked tires are available from Custom Racing Products (P.O. Box 1485, Temple City, CA 91780) to fit most Hotshot, Tamiya, and Yokomo cars and rims. Hotshot front and rear tires are $9.95 a pair; Tamiya rear tires are $9.95 a pair (fits Frog, Hornet, Grasshopper, Super Champ with 1½-inch DIA rims) and Yokomo tires are $9.95 a pair (fits any 1¾-inch glue-on rims, Yokomo, Twinn-K, BoLink, and Parma). Also fits Tamiya Lancia, Audi and Opel rea rims.

HOTSHOT FRONT SUSPENSION PIVOT BALLS: Replace weak alumin pivot balls with chrome-plated st balls from Custom Racing Prod (P.O. Box 1485, Temple City, C 91780). They reduce the chance wear and breakage and are desig to fit the newer steering blocks w larger threaded holes.

ECONO FAST CHARGER: This fast charger from Texxon Precision Products (P.O. Box 420496, Miami, FL 33242; 305-634-3630) is for 7.2V 1,200-mAh nickel-cadmium battery packs. It includes a Tamiya connector and an LED pilot light. The Econo Fast Charger charges your batteries in just 15 minutes.





AC/DC VARIABLE RATE AUTO CHARGER: This charger from Texxon Precision Products (P.O. Box 420496, Miami, FL 33242; 305-634-3630) features a charge and discharge mode with indicator light, a trickle charge mode with indicator light, 6-foot input power cords, and circuit protection with a 5 amp fuse.

KYOSHO PEGASUS: Easy assembly, operation and maintenance make this 2WD electric off-road car from Great Planes Model Distributors (P.O. Box 4021, Champaign, IL 61820) perfect for the beginner! The Pegasus offers several high-performance features at an affordable price. The nylon suspension components and plastic chassis box keep its weight very low. It comes with a Mabuchi RS-540S electric motor. A gear-type rear differential distributes power effectively on loose terrain. Four coil-spring shocks and independent front suspension smooth out bumps and facilitate good handling.

GREASED LIGHTNING:

Here comes a high-performance, off-road Dune Buggy specifically designed for *all* off-road freaks. From Monogram Models (8601 Waukegan Rd., Morton Grove, IL 60053-2295; 312-966-3500) comes Lightning, which can be completely assembled in one hour and is ready to roll that day. That's right—this kit offers a *complete* package, which includes a complete radio, installed servos, Mabuchi motor and receiver, nickel-cadmium battery and charger, and ten AA Duracell batteries. ZZZING! Lightning is ready to go!

X-ACTO CATALOG:

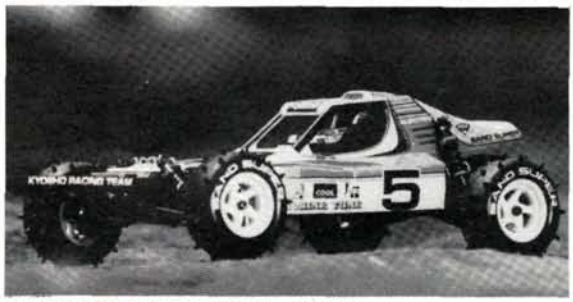
For 50 years, X-Acto (Hunt Mfg. Co., 230 S. Broad St., Philadelphia, PA 19102; 215-732-7700) has led the industry in creating successful products such as high-quality knives, blades, scissors, precision tools, and sets. Now X-Acto is the leading supplier of precision cutting instruments. Their knives have thousands of modeling applications and their new catalog is packed with information to help you select the proper knife/blade combination.

WANT MORE SPEED?

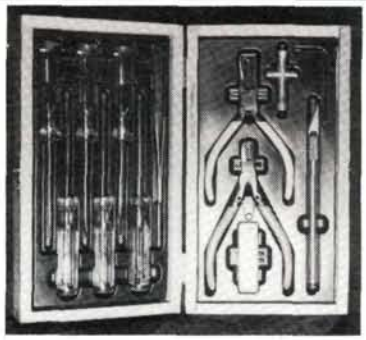
Associated (1928 E. Edinger, Santa Ana, CA 92705; 714-547-4986) offers the new Reedy Modified motor for off-road racing that will really increase the speed of your car! For only $70, order #6510 if you drive on a road course and #6511 if you drive on an oval course.

XL2P CAR RADIO:

The XL2P car/boat radio by Airtronics (11 Autry, Irvine, CA 92718) has a well balanced pistol grip handle that easily reverses for ambidextrous use. The superior design provides the modeler with sensitive trigger throttle response and precision control. This powerful and rugged radio is lightweight and features a posi-grip wheel with adjustable steering tension, a compact state-of-the-art receiver, and optional nickel-cadmium rechargeable battery. The XL2P is available at your local hobby shop or from Airtronics.



KYOSHO OPTIMA 4WD: No "hopping-up" is necessary with this 1/10-scale off-road racer from Great Planes Model Distributors (P.O. Box 4021, Champaign, IL 61820). Without any modifications, the new Kyosho Optima 4WD has what it takes to be a consistent race winner. It has a sophisticated, double-wishbone, four-wheel independent suspension system and an efficient chain-drive mechanism that is enclosed to protect it from water, rocks, mud, etc. Oil-filled shocks are featured on all four wheels and the strong aluminum ladder-type chassis and virtually indestructable front bumper are built to endure strenuous competition.

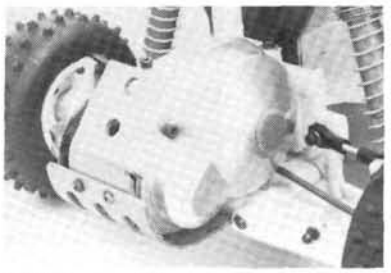


TOOL KIT: MRC (2500 Woodbridge Ave., Edison, NJ 08817) announces the introduction of their R/C Car and Buggy Tool Set. Included are two Phillips and two flathead screw drivers, an awl, a hole driller, stainless steel tweezers, wire cutters and pliers with non-slip handles, a hobby knife, a bonus package of replacement blades, a four-way metric cross wrench, and two metric Allen wrenches. Whether building or out at the track, the MRC Tool Set will always come in handy.

What's New

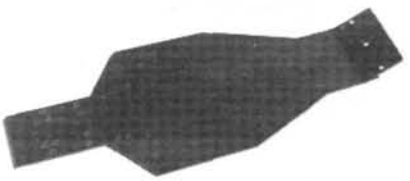
ACCESSORIES FROM PARMA

D&D graphite shock mounts for RC10. Reduced flex for better shock action, $13.



RC10 gear dirt cover has press-in cap that allows access to the differential adjustment nut without removing cover, $3.

The 54-tooth Kimbrough gear is smoother running and more efficient than some standard gears, $3.75.



The graphite chassis for Associated RC10 is a weight saver for the serious racer, $88.

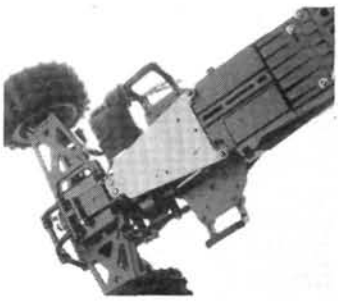
(13922 Progress Pky., N. Royalton, OH 44133)

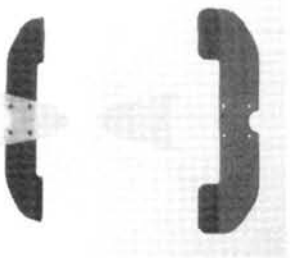
AYK BUFFALO: Here comes one of the most sophisticated 2WD off-roaders from AYK Racing (Condor Trading Company International, P.O. Box 3479, Mission Viejo, CA 92690). It is the best in running and the durability required for racing. The Buffalo includes double wishbone suspension in the front, aluminum rudder frame chassis, a newly designed compact gear box, front and rear stabilizers, rear tires, and spikes. It's an eas operation, even for beginners.

CHARGE! The new Associated (1928 E. Edinger, Santa Ana, CA 92705; 714-547-498 6/7 charger can charge either 6 or 7 cells for off-road cars. It includes discharger, trickle charger ampmeter, and 30-minute timer. The 6/7 charger is $40 from Associated.

JAC-RABBIT: Raco Modelcraft's (1421 E. St. Andrews Pl., Santa Ana, CA 92705; 714-546-2347) Jac-Rabbit is a car with the size and realistic looks the true off-road R/C enthusiast wants. It is rugged enough for any terrain and will run for a full hour on a tank of gas and a full charge. It features changeable gear ratios, enclosed gear drive, disc brakes, independent suspension with oil-filled shocks, neoprene semi-pneumatic tires, and a fully chromed steel roll cage. The engine is a 1¼ horsepower forced air-cooled two-stroke with solid-state magneto ignition and recoil starting. All you need to supply is your own radio transmitter and receiver—the Jac-Rabbit includes high-load servos.

HOT SHOT BATTERY TRAY/ BATTERY DOOR AND NERF WING:

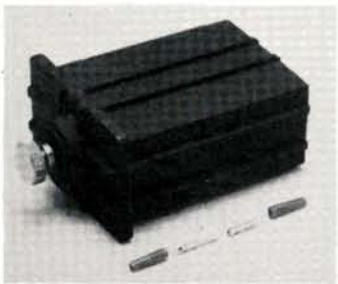




Made of G-10 fiberglass, this new plate reduces chassis flex.The tray is drilled to accept #3046 Hot Shot Nerf Wings, which protect the inside rear wheels and suspension, and the bottom of batteries from being scraped. Mounts to #1028 Hot Shot battery door. All are from Custom Racing Products (P.O. Box 1485, Temple City, CA 91780).

ROBBE ROKRAFT HEC AND *EXPERT* HEC:

The Rokraft HEC is a super speed controller for 1/10 and 1/12 cars. The extremely sensitive speed control provided by Robbe (180 Township Line Rd., Belle Mead, NJ 08502) HEC circuits guarantees the max in operating times from your batteries. The expert HEC is a competition speed controller for 1/10 and 1/12 R/C cars with 5 to 6 nickel-cadmium cells. This fully electronic speed controller provides infinitely variable control over the ranges forward-stop-brake-reverse and features receiver power supply circuit, electronic bypass circuit, and high pulse frequency.



Rx BOX: Robbe's (180 Township Line Rd., Belle Mead, NJ 08502) Rx Box protects your receiver from moisture and dirt. It features sealed openings for two servo leads, one power supply lead, and the aerial lead. The quick-release cap allows rapid crystal changing without a complicated dismantling exercise. The Rx Box fits most popular AM and FM receivers.

THE PRO-110 is an exciting new challenger from MRP (18676 142 Ave. N.E., Woodinville, WA 98072-8521). This 1/10-scale car has features like fully adjustable ball differential, pressurized coil-over adjustable shocks, a motor plate that can be flipped for mid or rear motor positioning and all ball bearings. The Pro-110 starts where other R/C cars leave off; it's ready to take on the competition right out of the box!

PRECISION POWER TOOL:

Black & Decker's (Consumer Power Tools Division, 3012 Highwoods Blvd., Raleigh, NC 27625; 919-878-4100) new precision rotary tools are as much as 20% smaller and lighter than comparable tools on the market. With virtually thousands of modeling applications, they are ideal for accurate drilling, grinding, etching, polishing, and carving. They are available in 50-, 100-, and 150-watt power models and run quietly without producing excess motor heat.

AUTOMAX 21: From Robbe (180 Township Line Rd., Belle Mead, NJ 08502) comes the Automax 21, a rapid-charging unit especially designed for charging or topping up sintered-cell nickel-cadmium battery packs from a car battery. A powerful DC voltage converter enables it to charge packs containing a large number of cells. The Automax 21 also includes an automatic circuit for terminating the charging process. This means that batteries can be fully charged rapidly and safely, regardless of their previous state of charge.

BIG & BAD HIGH ROLLER:

Hot news from MRP (18676 142nd Ave. N.E., Woodinville, WA 98072-8521)! It's the biggest of the big and the baddest of the bad! The High Roller has 1/10 Terra tires 6 inches tall and 3 inches wide. It can be shifted from two-wheel front steering, to four-wheel opposed steering, to four-wheel crab steering. The High Roller uses either a 2- or 3-channel radio and comes with a high-performance stock 540 motor. The 35-to-1 gearing gives awesome pulling and climbing power.

Radio Talk

by Charlie Kenney

THERE ARE radios particularly designed to control R/C cars powered by electric motors or gas engines. A good place to start in discussing these radios is with a block diagram of a generic R/C system, as you'll see in Figure 1.

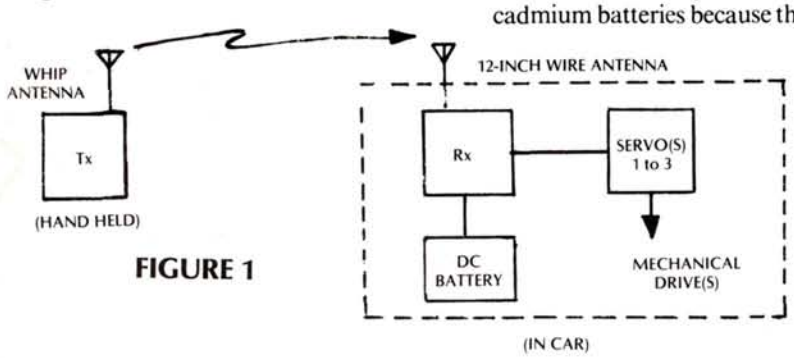


FIGURE 1

For cars, the transmitter will operate on either 27 MHz or 75 MHz in accordance with the rules and regulations of the Federal Communication Commission (FCC). The transmitter's purpose is to generate and control a signal format sent to a vehicle. Most car radios have two functional control channels for steering and throttle control, with a third channel possibly used for mixture control. The transmitter sends RF signals to the receiver by means of its antenna, usually a short, multi-section whip which is about 30-40 inches long extended and 6-8 inches long retracted. This signal is received by the receiver, decoded, and sent to the servos where the electrical signals are converted into mechanical motion. This motion is transmitted by means of a mechanical linkage such as a pushrod to move the wheels right or left or to move a throttle to high or low. All modern radio systems use proportional control so throttle and steering can be moved independently to any position within the control extremes. Thus, servo movement is directly proportional to the movement of the control stick or wheel. The purpose of the receiver battery backpack is to provide power to the receiver and servos. If you plan to run an electric car, a separate battery is required to power the car. While on the subject of batteries, radio sets can be bought with dry cells (usually alkaline cells) or rechargeable nickel-cadmium batteries. You will find that there is about a $40-$50 difference in price for the nickel-cadmium batteries because they are more expensive and a charger is required. However, because they are rechargeable, they save money for an active driver.

Three transmitter configurations (Type A, B, and C), are currently available and are shown in Figure 2. Type A utilizes two sticks. The right stick, normally used for steering, is spring-loaded and moves right and left from neutral. The left stick, which moves back and forth, is used for throttle or speed control. The throttle stick, however, is not spring-loaded, but detented. This means it can be moved from low to high to low, and stopped anywhere in between without neutralizing.

Note: If you are left-handed, sticks on Type A transmitters can be changed so that steering is on the left stick and throttle is on the right. Trim controls are associated with each stick so that you can change the end or neutral positions of both servos slightly. Full throw of the sticks is normally 60° or plus-or-minus 30° from neutral.

Futaba's Magnum Junior is a two-channel system with pistol-grip feature.

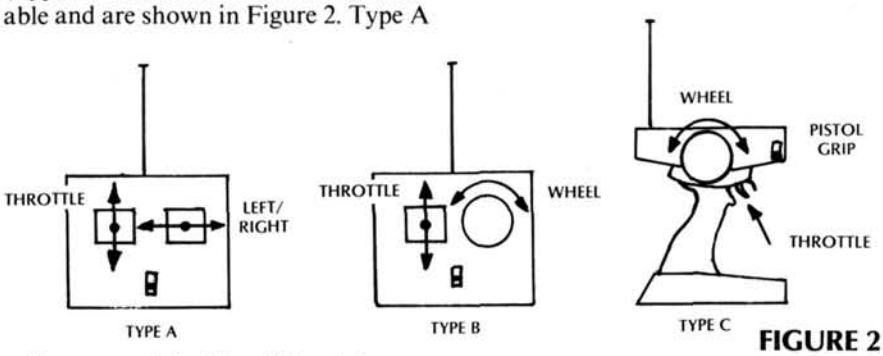


FIGURE 2

The Type B transmitter is similar to Type A but uses a wheel for steering rather than a stick.

Type C reflects a newer type configuration, the Pistol Grip. This configuration uses a wheel for steering and a spring-loaded trigger for throttle. Trim controls are provided and in some models, servo-reversing is available. Servo-reversing is a nice feature to have as you can install your servos in the car, attach all linkages and, if one or both

Two-stick systems are also popular for radio car racing. This is Futaba's FP-2-T2L.

Airtronics version of a pistol-grip racing radio has many desirable features.

Futaba's newest two-channel system is a traditional two-stick model.

controls are moving in the wrong direction, reverse the servo switches on the transmitter and everything will be moving in the right direction. Some Pistol Grip transmitters offer a right-handed to left-handed configuration by simply reversing the pistol grip.

All transmitters have self-contained batteries and usually have removable crystals for frequency change within the assigned 27 and 75 MHz frequencies. Remember, if you change frequencies, you must change both the transmitter and receiver crystals. The authorized frequencies in the 27 MHz and 75 MHz bands that are available right now for surface models are shown in the chart.

The portion of the radio system that goes into a car consists of a small receiver/decoder unit, two or three servos, a battery pack, and an On/Off switch harness which will also contain a charging jack if your set uses nickel cadmium batteries. A recommended location for the receiver and servos is normally shown in your car's instructions. The receiver is usually wrapped in foam and placed in its compartment. Sometimes it's fastened by means of double-sided foam tape, which helps isolate the receiver and decoder from vibrations and protects them from accidents.

Servos are mounted by screws, usually with brass eyelets and rubber grommets. Always allow some compliance in your servo mount. This can be accomplished by tightly turning the mounting screw and backing off about one turn. The battery pack can be held in place by bracket or rubber bands. It is recom

CAR RADIO SUMMARY

MFG.	MODEL #	MOD. FM/AM	FREQ. MHz	NO. CHAN.	TX TYPE	SERVO REVERSE	NO. SERVOS	BATTERIES	REMARKS
AIRTRONICS	CS3W	FM	27	3	B	Yes	2	Dry	Dual Rate/Expo.
	XL2P	AM	75	2	C	Yes	2	Dry	Reversible Grip
	CS2P	FM	27, 75	2	C	Yes	2	Dry	Reversible Grip
ALTECH	Agcom 2	AM	75	2	A	No	2	Dry	
CIRCUS	Circus 2	AM	27, 75	2	A	No	2	Dry	
FUTABA	FP-2F	AM	27	2	B	No	2	Dry	
	FP-2NL	AM	27	2	A	No	2	Dry	New Sticks
	FP-2PKA	AM	27, 75	2	C	Yes	2	Dry	N.C. Conv.
	FP-3PG	AM	27, 75	2	B	Yes	2	N.C.	Reversible Grip
	FP-2L	AM	27	2	A	Yes	2	Dry	N.C. Conv.
HOBBY SHACK	Aerosport	AM	75	2	A	No	2	Dry	
KRAFT	KP-2KW/B	AM	27, 75	2	C	Yes	2	Dry	N.C. Conv.
	KP-3KW/B	AM	27, 75	3	C	Yes	2	Dry	N.C. Conv.
	KP-2KB	AM	27, 75	2	A	Yes	2	Dry	
POLKS/ HIGH TECH	302 PX	AM	75	2	C	Yes	2	Dry	Reversible Grip
TOWER	GX 202	AM	75	2	A	No	2	Dry	Double Tuned RX

Full-feature Futaba Magnum 3-channel is a top of the line radio; has left- and right-hand steering.

Another pistol-grip radio, this available from Polk's Hobbies as the Challenger 2P.

mended that a 12-inch vertical whip antenna be used for your car. This is normally provided in the car kit with a bobbin around which the regular receiver antenna is wound. A typical installation involves soldering a small solder lug to the end of the receiver antenna and mounting it to the whip antenna and chassis with a screw. Make sure there is good contact between the solder lug and the antenna. A small whip antenna works well with the short ranges associated with cars. A mounting cutout for the car unit On/Off switch is usually located on the underside or back of the car chassis. Car power can be an engine or DC battery pack and electric motor.

Many off-road racers are powered by two-cycle engines and include special features such as built-in glowplug connections, a carburetor prime, and pull-start systems. On the other hand, electric road racers are also very popular. They require a husky electric battery (7.2V DC 1,200 mAh pack) and a fast charger to charge the battery before each run. I think electric cars are easier for your first endeavor; but, if you've had engine experience, you can jump right to a gas-powered, off-road racer. If you have any radio questions, send them along to me and I'll do my best to answer them.

Charlie Kenney, c/o *Radio Control Car Action,* 632 Danbury Rd., Wilton, CT 06829. ■

FREQUENCIES FOR SURFACE MODELS

27 MHz	Color	75 MHz	Channel
26.995	Brown	75.430	#62—Blue-Red
27.045	Red	75.470	#64—Blue-Yellow
27.095	Orange	75.510	#66—Blue-Blue
27.145	Yellow	75.55	#68—Blue-Gray
27.195	Green	75.590	#70—Purple-Black
27.255	Blue	75.670	#74—Purple-Yellow
		75.710	#76—Purple-Blue
		75.750	#78—Purple-Gray
		75.790	#80—Gray-Black
		75.830	#82—Gray-Red
		75.870	#84—Gray-Yellow

'32 HIGHBOY

(Continued from page 54)

for a right turn. You've already won the race and he knows it.

And you smile a little, as you ease in the clutch and drive on into the night. Hot rods are forever and '32 highboys are for even longer than that.

The Deuce highboy featured in these pages was built by Mark Conforth in the late '60s and proves that highboys are forever because he still owns it nearly 20 years later. Mark, who calls Sussex, New Jersey, home, wanted a classic highboy and that's what he has built. From the wide whitewalls to the chromed flathead ngine and the '39 Ford taillights with the blue-dot inserts, *this* is a hot rod. Check out the chromed drop axle and the '48 hydraulic brakes, and don't miss the little turn signals mounted on the frame horns. It's the details that make it classic and it is the details put into a model that make it a miniature piece of a time long gone. Besides, it's all those little details that make modeling a car like Mark's highboy so much fun. ■

CIRCUS WHEELIE

(Continued from page 47)

features a variable steering rate which is easily adjustable while driving, and a three-position throttle trigger for models which have forward only, forward and a brake, or forward and reverse. The transmitter also allows for full adjustment of the steering wheel angle and centering tension. Servo reversing switches are provided on both channels.

The receiver measures 60x40x20 mm and weighs 1.5 ounces. The HS-306 servo features an indirect drive, sealed potentiometer and a strong, low backlash plastic gear train. It measures 52x20x48 mm, weighs 1.6 ounces and is water and dust resistant. Claimed output torque is 45 inch-ounces. The servo reversing and the adjustable-length servo arms made radio installation and adjustment a breeze. The radio has a very solid feel to it. The servos center well and have a relatively tight deadband. The adjustable steering rate works great for changing the steering sensitivity but it also changes the servo center position if the trim is not exactly at neutral. This isn't critical on my sport car, but it could be quite annoying on a competition car or boat. The radio is available on both the 27 MHz and the 72 MHz bands. The radio provided was on 27.145 MHz.

DRIVING. The instruction manuals for the car and radio provide a good discussion on setting up the car and troubleshooting any problems that might arise. I initially set my car up for racing with the motor battery placed in the tray between the wheels. This gives the car a nice low center of gravity for stability. I was surprised to see that the car is quite fast even though it only has a 5-cell battery pack. The steering is very positive with a nice tight center. The car handles dirt, short grass, and bumps well. However, since the motor and all of the radio equipment are exposed, the car should *not* be run through puddles.

After about 2 hours of race driving, I changed the equipment positions for wheelie driving. In the racing mode, the car has to be coaxed into a wheelie by running it in full reverse and then giving it full forward throttle. In the wheelie

(Continued on page 80)

Charge!

Getting a Charge into, *and out of,* Your Batteries

by Douglas R. Pratt
photos by Jennifer Pratt

IF YOU WANT to run electric cars, there are some things you need to know about batteries because you deal with them constantly. If you race, you'll want to squeeze every last drop of juice out of your drive pack. Even if you just go out and bash around in your yard, you'll want to know what you're doing when you charge. Otherwise, you'll be buying batteries every other week.

Nickel-cadmium batteries are remarkable little creations, skillfully designed with a lot of power density. They are very lightweight, especially when compared with conventional lead-acid batteries. When we fast-charge and fast-discharge sub-C nickel-cadmium batteries (the size found in almost all car packs), we're pushing the limits of their design. I had occasion to talk with a representative of a major battery maker several years ago; when I described the sort of charge/discharge cycles we use in running R/C cars, she was shocked that we were doing *that* to her batteries and getting away with it!

Well, we *don't always* get away with it. You've probably heard horror stories about fried packs, vented cells, and the like. But, if you're reasonably careful, there's no reason why a typical pack shouldn't stay good for years; many of mine last that long. The key is an understanding of what's happening when your batteries are charged and discharged.

The main enemy of nickel-cadmium battery packs is heat. A nickel-cadmium cell is made up of a tightly wound spiral of metal packed with a chemical electrolyte. When it warms up, the chemical expands. A cell can get up to about 120° with no problems; it's designed to take it. If you let it go over 120°, a little vent opens on the top of the cell and releases some of the electrolyte. This serves the very useful purpose of keeping the cell from exploding, but it also means there's less electrolyte in the cell to do its work. So cells that have vented are always diminished in capacity, sometimes to the point of being useless.

So heat is the killer. The problem is that the cells themselves generate heat under two conditions: during fast discharge and during overcharge. The heat build-up during fast discharge is unavoidable, and is almost always within the design limits of the cell as long as the heat is allowed to dissipate. That means that your cells should be exposed to the air in some way, as they are in almost all cars. It also means that drive packs should never be wrapped in foam rubber or other insulating material. (Receiver batteries discharge much more slowly, so they can be wrapped in foam if necessary.)

Your pack is going to be warm after a run. Let it cool down before sticking it on the charger. Otherwise, the normal heat generated in charging could create a condition known as "thermal runaway," which is a polite way of saying you'll fry the pack. Ideally, you should own three packs for a car you want to run heavily; one to charge, one to run, and one to be cooling down.

Overcharging is the other cause of heat, and here is where most packs get fried. Make it a habit to grab your battery near the end of a fast-charge cycle and see if it's getting too hot.

FAST CHARGING. Most of the charges you put into your drive packs will be fast charges. A fast charge uses current that averages around three times the capacity of the cells. For 1,200 mAh packs, the average fast-charge current should be around 3.6 amps. The cells can take up to 6 amps at the beginning of the charge. In fact, some of the simpler chargers start out at this high rate, and

This Astro Flight charger will fast or slow charge all battery sizes; voltmeter allows checking for voltage peak.

the charge current tapers off as the batteries charge. They do this by reacting to the internal electrical resistance of the pack, which increases as the charge increases. Several of the Astro Flight* and Leisure Electronics* chargers have amp meters on the face to show how much current is being fed to the pack. You can use these to roughly determine the state of charge; if the current is over 4 amps, the pack is pretty flat. Charge current should taper off to an amp or less at the end of the charge.

If you have a more sophisticated charger, you can set the charge current. "Constant-current" chargers allow you to determine the amps going into the battery, and they hold that current steady throughout the time you set. You can safely charge a flat pack at 4 amps for 15 minutes. If you want to charge for less time, increase the current. If your pack has a partial charge, you can safely bring it up by charging at a lower current —say, 2 amps—for 15 minutes. As always, monitor the temperature of your pack to make sure it isn't overheating.

Constant-current chargers also allow you to charge packs with different numbers of cells; from 4-cell receiver packs to 8-cell transmitter packs. Follow this rule of thumb: 1/10 capacity for a slow charge, and 3X capacity for a fast charge. This can be very useful if your transmitter runs down on the field. However, remember that not all nickel-cadmium cells are designed to accept a fast charge. To be safe, always slow charge when you can. If you have to give your transmitter or receiver pack a boost, try charging at one times the rated capacity. Most transmitter and receiver batteries are 500-mA capacity, so charging at ½ amp for 10 minutes should be perfectly safe.

TRICKLE CHARGING. There are two methods of charging that are useful to R/C drivers: fast charging as I've already discussed and trickle charging. Trickle charging is slow-rate charging that takes up to 24 hours to complete. It's important because it's an absolutely safe and sure way to get a 100% charge into a battery pack. When you come home with a new battery pack, your first step *must* be to give it a 24-hour trickle charge.

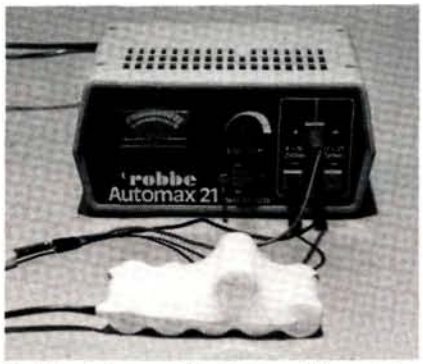
Trickling the pack performs another important function. Each cell in the pack will charge and discharge at a slightly different rate than the cells around it When fast charging, one or two of the cells in the pack will be fully charged before the others. When a cell with a full charge has charge current applied to it, the current turns to heat. So when a pack does get fried, some cells will vent before others. Trickle charging the entire pack will bring all the cells up to 100% charge at a safe rate. Some of the cells will reach 100% before the others, but the current being applied during trickle is so low that no damaging heat is generated. This is known as "balancing a pack." When a new pack is described as having "balanced" or "selected" cells, it means that the individual cells have been tested and matched with cells that come very close to the same rate of charge discharge acceptance.

The usual current for trickle charging is 1/10 that of the cell's capacity or less. So the standard sub-C cells, which are rated at a capacity of 1,200 mAh, should be trickle charged at 120 mA.

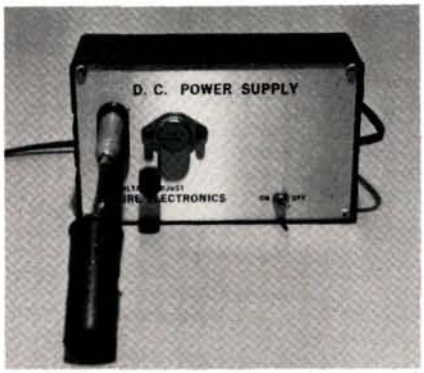
PEAK CHARGING. If you're racing, or you're interested in getting the maximum run out of a pack, you'll want to try peak charging. This takes advantage of a useful characteristic of nickel-cadmium batteries. As they charge, the voltage rises steadily, then levels off. At the moment of peak charge, the voltage will begin to fall slightly. If you charge until you detect that peak, you'll have as much charge as the cells will hold.

(Continued on page 80)

The MRC RB-450 charger does everything; 2 charge modes, discharge, and motor test. Plug adapters provide flexibility.



Robbe Automax 21 charges different size battery packs up to 20 cells and detects voltage peak.



If your charger only works on 12V, try this Leisure Elec. adjustable power supply.

Off-Road Driving Care

courtesy of the Tamiya Corp.

OVER-RUNNING YOUR CAR CAN CAUSE MISHAPS AND PROBLEMS

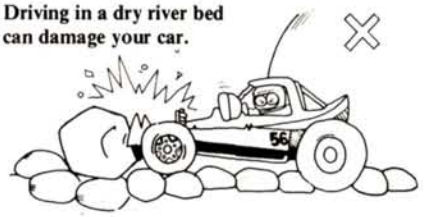
Even though you own an off-road vehicle, you must select your driving areas with care to keep your vehicle in good condition. Inconsiderate driving will cause trouble and possible damage to your car.

1. Unsuitable Driving Surfaces

- **Dry River Bed**

A dry river bed where many large rocks are found is perhaps the worst place for iving an off-roader. In 1/10-scale, a stone th a 2½-inch diameter is the same as a -foot diameter boulder in real life. riving against these objects is like intentionally destroying your vehicle.

Driving in a dry river bed can damage your car.



- **Grassland**

Grasslands with tall grass and stems are bad for buggies because the grass can become entangled in the rear shafts and universal joints, which causes an unnecessary load on the motor and can cause overheating.

Note: Grass can become entangled in rear shafts.

2. Surfaces That Require Special Handling

- **Asphalt and Lawns**

High-speed cornering on concrete, asphalt or smooth lawns will cause the vehicle to roll. Slow down a little when cornering on these surfaces.

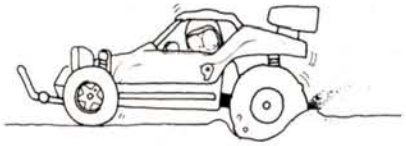
Do cornering on pavement at lower speeds.

3. Difficult Surfaces

- **Gravel and Dry Sand**

These surfaces offer considerable resistance to your vehicle. There is a burden on the motor and it will use much more current. The vehicle will not move as fast on this type of terrain, and on loose, dry sand the tires can become buried and will spin, without moving the car.

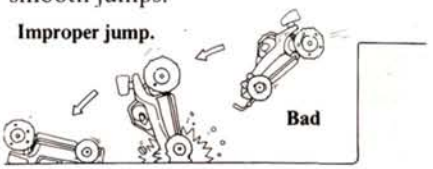
Tires dig into sand.



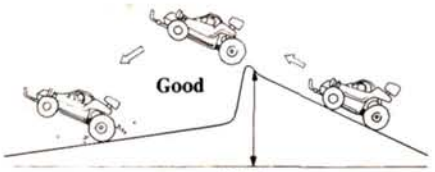
4. Jumps

Dynamic jumping is a part of off-road driving; however, you can damage your car if you do it recklessly. A jump must be done so that the rear wheels land first, with the vehicle level. In order for it to be in a level slightly nose-high attitude, you must leave the ramp squarely and not enter it from an angle. If you do not do this, the car will tend to tumble while it is in the air and land off balance. Your jumping ramp can be up to 8 inches in height for safe, smooth jumps.

Improper jump.

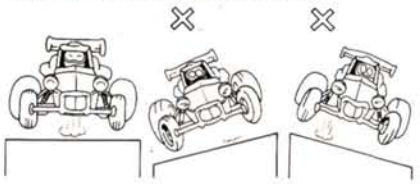


Good ramp; good jumping style.

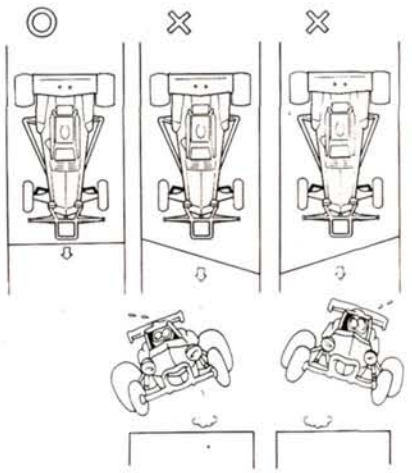


Heights up to 20 cm.

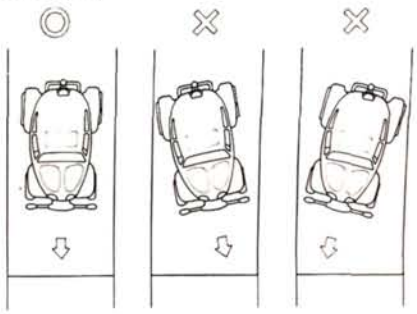
Upper surface of jump ramp is level.



Jump ramp must not be distorted.



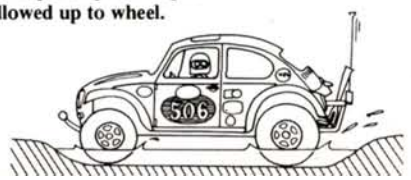
Straight jump!



5. Water and Ponds

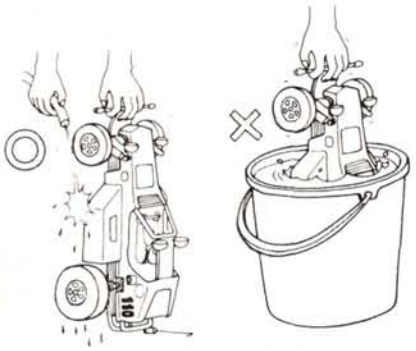
Although the Rough Rider and Sand Scorcher, plus others, are water-resistant, water can enter the mechanism box due to water pressure if the car is allowed in deep water. The safe depth of the water hazard is up to the lower edge of the wheels.

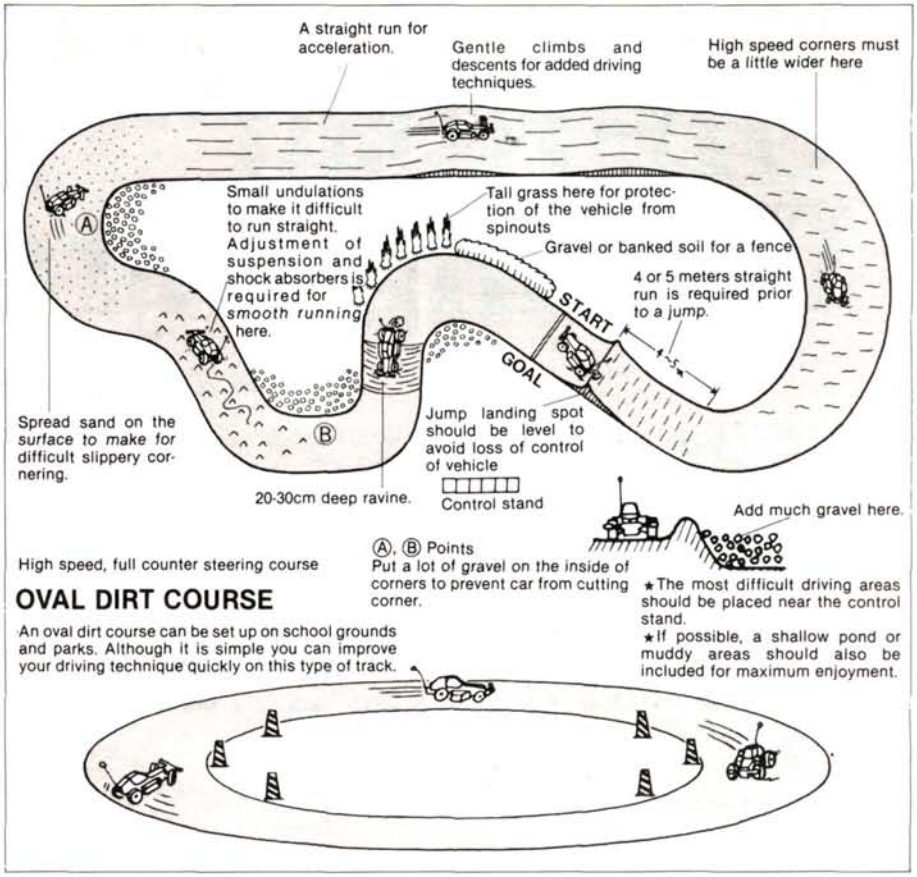
Note depth of pool. Depth is allowed up to wheel.



6. Care in Washing the Car

Cars with water-resistant boxes can be washed down with a hose if they are dirty. Hold the vehicle by the front bumper and let it hang down vertically while cleaning off with the hose. Do not dip the car into a bucket of water because the pressure will allow water to enter into the box through the vent holes. For a thorough cleaning, it is best to remove the box entirely, then immersion into water will not harm the radio gear. After running the vehicle through water, or after washing, it is a good idea to open up the box and wipe out any moisture that may have been induced, then dry it in an airy place. Disassemble the gear box and oil the gears, bearings, and suspension.





IDEA ON TOP OF ANOTHER

ASTRO HAS ONE GREAT

#4007 R/C System Analyzer-Rapid Charger - Rapid Charge Receiver and Transmitter, and check capacity.

#4005C 6/7 Cell Charger - Charge 6 or 7 cell packs - used with 05 systems

#4025 Voltage Booster - Boosts voltage to 24v or 30v (16 or 24 cell packs). For 40 to 60 system packs. Works with any 6 or 7 cell charger.

#4005D Dual Charger - Charge two 4 to 7 cell packs at a time - Adjustable current.

#4005A Auto Charger - Charge 5, 6, or 7 cell packs, current monitor, auto "trickle" switchover.

#4005B AC/DC Charger - The "Rolls Royce" . . .12v or 110v input, charge 4 to 7 cell 250, 500, 800, or 1200 mah packs, auto "trickle" and adjustable current.

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KYOSHO VANNING

(Continued from page 29)

about 2½ feet in diameter, which the Vanning encountered once again due to driver error. To my surprise, there was no damage!

Flat out, the Vanning is awesome and it can reach speeds in excess of 50 mph. It is so fast that I would suggest you learn on a more docile electric before you tackle the Vanning. I say this because you have a lot less time to react and negotiate turns and obstacles at the high speeds the Vanning is capable of. Once you've graduated to the big leagues, then the nitro-burning Vanning is the way to go!

**The following are the addresses of the companies mentioned in this article:*

Tower Hobbies, P.O. Box 778, Champaign, IL 61820.

Pacer Technology & Resources, 1600 Dell Ave., Campbell, CA 95008. ■

Keeping It Together

Building is only the first step—maintenance is the key to the ***winners circle****!*

by Fred Fischer

MRC-Tamiya molybdenum grease is excellent on gears, rods, and bushings.

The Hotshot tie-rod assembly uses a new heavier ball joint and rod.

YOU'RE LEADING the pack of competitors in the final heat. No one can match your speed in the straights, nor can they slide their buggy as well as you can. Suddenly one front-suspension ball-link pops loose and you lose control! Now you're eating the other competitors' dust and limping into last place. What happened? Faulty parts? Probably not, more likely it was inadequate preparation that killed your chances of winning.

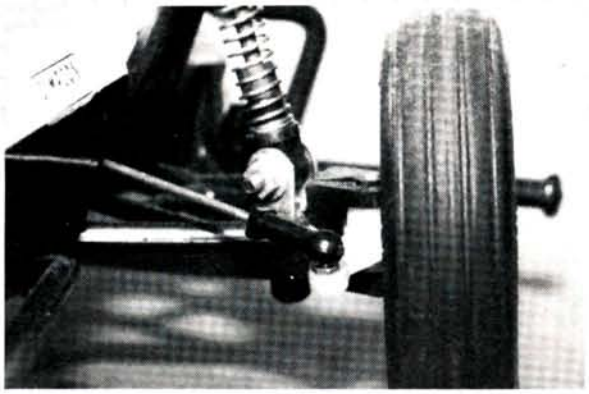
Although building the car right in the first place is very important, it is only the first step. Proper maintenance is the real road to the winner's circle. Let's look at how you can assure yourself of consistent performance with your buggy, even if you're not going to compete.

The first step to success is to build your kit right! Manufacturers usually put in many hours determining how durable their car is and they provide tips on assembly. Follow these tips and *read the instructions*! The number one reason many people have trouble assembling any product is because they don't follow the directions. Manufacturers could save plenty of money by printing minimal instructions, but they generally take the time to provide well-detailed construction booklets. Take advantage of their knowledge.

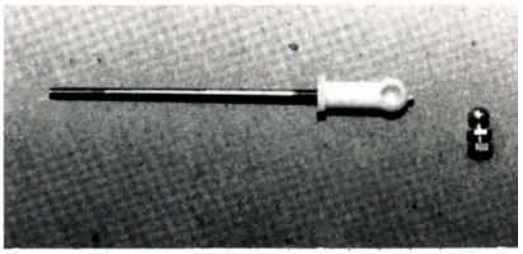
Let's get down to the "nuts and bolts." Manufacturers often specify the use of "metal cement" or something similar to hold nuts, bolts, and screws together. This prevents them from loosening under stress or vibration. If there are kits, or areas in the kits, where metal cement is not specified, check with the manufacturer or your hobby dealer to see if its use is okay.

Two warnings are in order here: use just a little metal cement on the threads of a nut or screw before tightening in place, since cement forms a tight bond between two metal pieces where they make contact. For example, don't put the cement over a nut and bolt because it won't flow between the threads. Also, be careful when using metal cement where metal

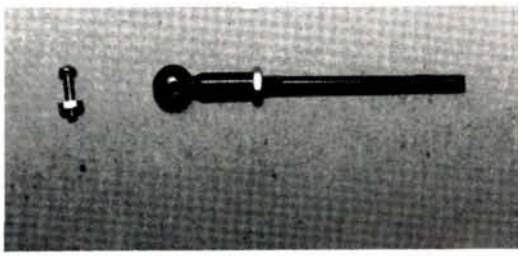
Keeping It Together



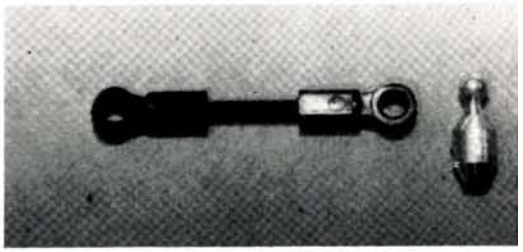
The plastic ball joint in a typical car. In this case, Tamiya's Grasshopper.



Plastic ball joint and brass ball are standard items i most R/C kits.



The metal rod ball is unbeatable for toughness, but it harder to adjust.



Newer style ball joint and ball are much stronger tha standard plastic ball joints.

makes contact with plastic. Many kinds of metal cement will cause plastic to soften or crack. It's wise to check material compatibility first. MRC-Tamiya makes a metal cement called "Liquid Threadlock" which doesn't attack plastic.

All of this will hit home if you're running your car and have to constantly tighten the screws. At play, it's a nuisance. At the races, it's a disaster!

Most kits use suspension and steering ball-joints that range in style from ¾-full to ball-joints that are more properly called rod-ball ends. For general "fun in the park," these joints are more than adequate. They should be greased from the start, however, to avoid excessive wear. Plastic joints also wear quickly and are soon falling off with every bump; greasing avoids this. Greased joints will attract dirt, so regular cleaning is in order. It sounds like a lot of work, but if you make it part of your routine, you won't notice the time. It is certainly better than stopping your car every few minutes to reattach ball-joints!

Most avid racers will tell you that plastic ball-joints won't take the stress of competition. Most manufacturers and many other specialty hobby shops now sell metal rod-ball ends or high-strength ball-joints that stand up to the rigors of racing. You lose the advantage of easy adjustment with the metal piece, but your suspension and steering end up with less slop and greater reliability. Why didn't manufacturers put such parts in the kit in the first place? Cost, of course. If the kit was more expensive, you might not have bought it. Don't forget that until only a few years ago most people thought of buggy races as a very minor sport. Manufacturers are now waking up to the fact that racing is big news. They are taking lessons from the competitors who race every day.

There is a simple change you can make to your steering that will make driving easier and faster. This adjustment is called "toe-in" and it is a measure of how much the leading edge of the front tires points inward toward the center of the car. I have often seen the front wheels of dirt cars pointing outward. Their owners are constantly complaining about how "touchy" steering is. They are bewildered about the car's poor performance. The front wheels of your buggy should point inward by ½° to 1°. Yes can usually adjust this by turning the ball-joints or rod-ball ends on the steering tie-rods. Toe-in will keep the car rolling straight even if you release the steering control on your R/C system. Less effort in steering means better control and more time to pay attention to the road or the race.

Remember to oil the bearings and grease the gear teeth or your gears will wear out very quickly. Electric motors spin at 10,000 to 18,000 rpm and run their torque through a gear-reduction system. They take occasional shocks whenever the drive-wheels are momentarily airborne, followed by abrupt landings. The drive system needs lubrication, yet many newcomers forget to oil, grease, and maintain the gears. Many kits feature sintered bronze bushings called oil-less metals. The name can be misleading since they require regular oiling to lubricate the space between the bronze particles which are designed to retain oil. Keeping those bushings free from grit is highly recommended. Ball-bearings are great for even less friction, but a little bit of oil on them is recommended anyway.

For the gears, I recommend light grease, such as petroleum jelly or molybdenum grease. Graphite grease is *not* recommended, as I've seen gears worn down to nubs with this stuff. Use graphite on door locks, not R/C dirt buggies.

Let's enjoy ourselves jumping and running the hearts out of our dirt cars, since we can use them longer with the tips I've jus outlined. Have fun!

Daily Maintenance

courtesy of the Tamiya Corp.

DAILY MAINTENANCE

Daily upkeep of any R/C car is important for maintaining performance. As a car is checked, any defects are seen and readily repaired or adjusted. Keep your car in the best possible condition and you will be rewarded with maximum speed and acceleration.

1. Care After Running

After running your car, be sure to clean it and make any necessary repairs—a regular routine is a must!

• Attending to Control Mechanisms

Track dust will always end up on your radio, switches, and servos; it is almost impossible to avoid. Therefore, switches must be cleaned regularly to avoid poor contact. Any component that is damaged or out of position should be replaced or repositioned. Check dry cells (if you are using them and we recommend that you do not!) under load—a simple voltage check is not enough; replace if necessary. Remember, inadequate battery power is the cause of many breakdowns.

• Dirty Components Around the Chassis

After a day's activity, all parts of your car will be dusty and dirty. Check all moving parts, particularly wheel bearings. Any foreign objects in the bearings will influence wheel rotation. For inaccessible places, use an oil spray with a detergent. Check all nuts and bolts. Oil all journal sections and check all axles to insure there has been no damage or bending.

• Damage to Body

Scale R/C cars not only must run well, they also must present a fine appearance. Any damage to the car body should be immediately repaired. Fortunately, the acrylic paints we use touch up nicely. Items you will need for body repair are plastic sheet, instant glue, plastic glue, and rubber cement.

2. To Keep Your Car at Peak Performance

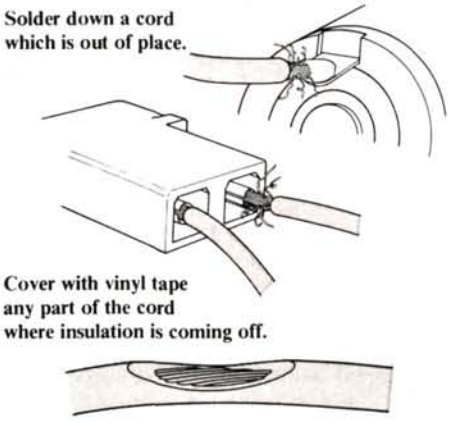
Parts will wear out or break after periods of high-speed running. Replace any damaged parts; usually the instructions for your car will contain a full parts list—use this to order any needed parts from the manufacturer.

• Maintenance of Electrical Systems

★ Repairing Electric Wire

Electrical wiring is able to withstand moisture and stretching to some degree. Unfortunately, wires are occasionally damaged and this can result in short circuits. Any suspect wiring should be immediately replaced. Failure to do this could result in substantial damage. Always remember that there is substantial current capacity in your car, particularly in the drive circuits. Antenna wiring must always be checked for short circuits and any rubbing on metal chassis parts. Just as surely, any radio wiring that rubs on the gear case or other car parts should be checked.

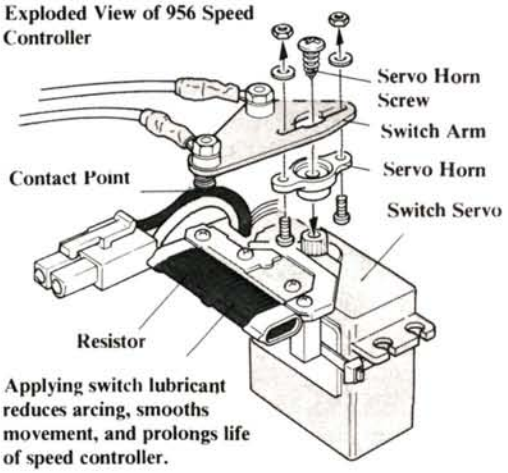
If insulation should ever be damaged, it must be mended immediately. Bits of wire can be spliced into place and covered by pieces of heat-shrink tubing. Any splicing should be done by soldering for a perfect electrical connection. If any repair problems show up that go beyond your abilities, refer them to the car or radio manufacturer.



★ Poor Wiring Contact

Since it draws a lot of current, the speed control will, ultimately, scorch its contacts. This scorching will in time cause poor contact. Therefore, contacts on the speed controller must be polished once in a while to allow electricity to flow with minimum resistance. Contacts should be polished with very fine finishing paper of 600-grit or so. When the metals of a speed controller are substantially damaged, they should be replaced.

Exploded View of 956 Speed Controller



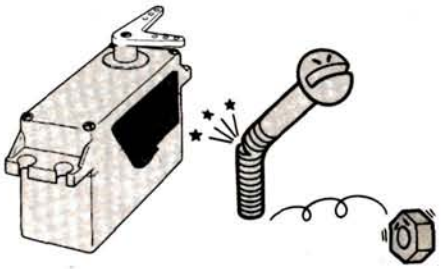
Applying switch lubricant reduces arcing, smooths movement, and prolongs life of speed controller.

• Maintenance of Mechanism and Chassis

★ Loosened Installation of Radio-Controlled Units

The adhesive power of double-sided tape is much reduced after one application. If the tape is reused to install servos or receivers, the units will be moved out of position due to accidents or vibrations. Loose bolts and nuts fixing the servo bands and servo trays might result in inaccurate control of the car. For installing steering servo and speed control servo firmly, renew the tape and tighten loosened bolts and nuts. Keep the double-sided adhesive tape in a cool, dry place, otherwise its adhesive properties might deteriorate. On the other hand, if the tape applied will not come off easily, wipe with a cloth dampened with benzine or water. The same cloth moistened with benzine assures strong adhesion if used to clean the surfaces of objects, i.e., servos and servo

mounts, before applying the new tape.

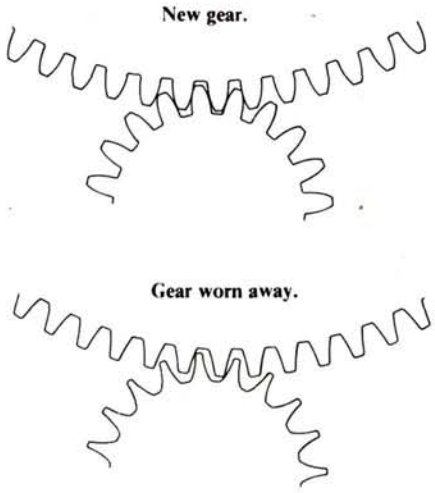


• Loosening and Deterioration of Bolts and Nuts

Nuts and bolts are indispensable assembly parts and can become damaged during the running of the car or by misuse. Screws tightened excessively might twist off, or the thread might become worn. Bolts can be bent during collision and, if not replaced, could snap off during racing with disastrous results. Therefore, it is sensible to always change any bolts and screws that are bent, cracked, or damaged in any way, before the next race. Check that all nuts and bolts, including lock nuts for fixing the shafts and all other small screws, have not slackened. Retighten if necessary.

• Meshing of Gears

The gears play a vital role in transmitting the motor power and they are subject to wear. Any dirt and dust between the gear teeth will act as a file and abrade the surfaces and any such deposit should be removed carefully. Occasionally gears can be broken by small pebbles and these gears must be replaced. Your car will run much better if regular attention is given to the careful cleaning, etc., of the gears. Check that the gears have not worn away so that they have too much play and cannot be adjusted. New gears require running in. If possible, do not use gears for races until the gears are run in.



• Damaged Chassis

The performance of your car will be greatly affected by the state of the car's chassis. A bent, warped, or otherwise deformed chassis will cause the car to have different cornering characteristics. A damaged front chassis and gear case will also adversely affect the performance of the car. Check for any twist or bend of the chassis by placing it on a flat surface. Sometimes a twisted chassis can be re-formed. A crooked chassis can possibly be repaired by pounding with a plastic hammer. However, this might weaken the structure and make it impossible to fit perfectly.

• Grease-Up Points

It is necessary to grease around front and rear axles to reduce friction and abasion. Any signs of rust should be handled with oil or grease, particularly if a car is run in water. Correct lubrication gives not only smooth rotation of wheels but also allows proper adjustment for steering, along with smooth operation. Gear teeth should be lubricated as well as suspension systems. In many cases, an oil spray will do the best job.

CIRCUS WHEELIE

(Continued from page 71)

mode, the throttle only needs to be abruptly advanced to full forward to start a wheelie. When the motor battery is fully charged, the car is able to wheelie even if the car is already moving forward. The motor battery lasts for about 15 minutes before it needs recharging, which takes about 12 minutes with a fast charger.

The Challenger 2P radio has worked well through all the bumps and bangs I've given it. The variable steering rate has proven to be a very handy feature. It only takes a flick of the thumb to tune the car for various surfaces instead of the tedious job of changing the servo and steering arm moments. In actual use, the steering centering changes with the rate adjustments were barely perceptible on smooth paved surfaces and not at all noticeable off-road.

To wrap it up, this car is a great value. It's a quality kit that is easy to build, great to look at, and fun to drive. It compares very favorably with similar kits costing twice as much. The Challenger 2P radio is a good one that is well suited to both cars and boats.

So go out and get a Circus Super Wheelie with a Challenger 2P radio and start having some fun.

**The following are addresses of the companies listed in this article:*

Circus Hobbies, 3132 S. Highland Dr., Las Vegas, NV 89109.

Du-Bro Products, Inc., 480 Bonner Rd., Wauconda, IL 60084.

Polk's Modelcraft Hobbies, 346 Bergen Ave., Jersey City, NJ 07304.

Tamiya, Model Rectifier Corp., 2500 Woodbridge Ave., Edison, NJ 08817. ■

CHARGE!

(Continued from page 73)

One caution: you've got to be alert for that voltage peak, because when the voltage starts to drop, the current you're pouring into your pack is turned into heat! You'll get an overcharge and vent your cells very quickly if you're charging at a current level of much over 2 amps.

You can safely peak charge if you have a digital voltmeter or a charger that automatically senses the voltage peak.

Peak detector chargers are understandably popular. Some you can set and forget, come back in 20 minutes, and find a peaked and unfried pack. The circuitry to do this costs money, so these chargers are more expensive than the simple kind but, in my opinion, they're well worth it.

There are quite a few peak detector chargers on the market. BoLink* makes one that allows you to set the maximum voltage level manually; you can monitor your pack through a couple of fast charges and note the voltage peak, then set the charger to turn off when it gets to that voltage. Delta* was one of the first companies to get into peak charging and they still make the simplest unit. It switches from peak to trickle charge rather than shutting off completely. You can also use the trickle charge without fast charging to balance a pack. Robbe* makes an excellent charger that detects peak voltage and allows you to charge as many as 20 cells from a 12-volt battery; fliers of electric airplanes use this feature a lot.

(Continued on page 82)

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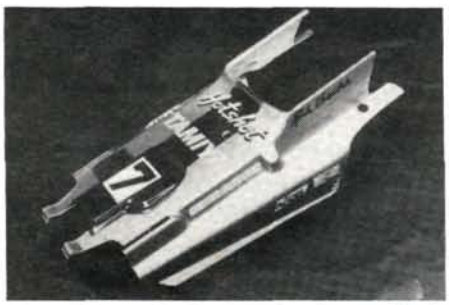
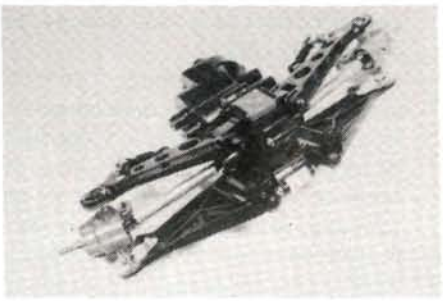
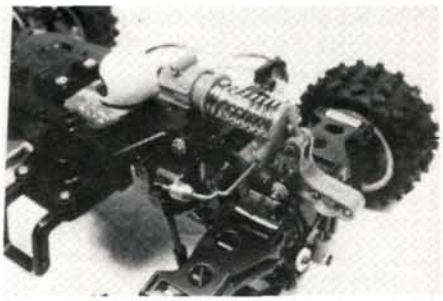
MRC-Tamiya
HOTSHOT



Polycarbonate body after trimming and final inside painting; very attractive result.



Front suspension exhibits the same rugged qualities apparent throughout the Hotshot.

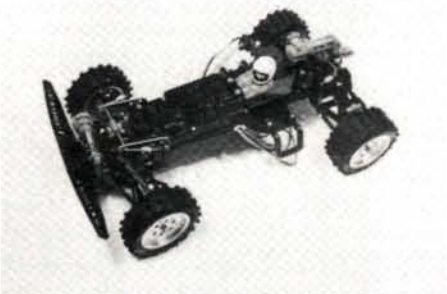


An oil-filled shock, as well as a torsion bar, is utilized on the rear suspension.

MRC-Tamiya Hotshot kit is very complete; organized packaging greatly helps assembly.

Rear suspension and gear box. Note shrouded motor at right center.

Completed car has that racer look; appears to be doing 60 while standing still.



Completed underpinnings without the body and wing.

CHARGE!

(Continued from page 80)

MRC* makes a super-duper charger, the RB-540, that has read-outs of voltage and charge current. It can be set to detect the peak voltage, or a manual charge. The manual mode can be used to charge at a slow rate for balancing packs. The charger can be set to show the voltage of your power supply, which is handy to make sure the charger is getting the input power it needs. It will discharge a pack at a safe rate, displaying the voltage during the process. And, as if all that weren't enough, it'll display the current draw of a motor plugged into it, to help tune up and break in the motors. Any serious car hobbyist should have a charger like this.

SIMPLER CHARGERS. If you want to save some money, you can do almost all of this tricky stuff with an inexpensive charger and a digital voltmeter. Meter-type voltmeters won't do; you're going to be looking for a voltage drop of two or three hundredths of a volt, and that's almost impossible to detect with a non-digital meter. I've gotten excellent service from a digital voltmeter I picked up at a local Radio Shack for $49.

Once you have the meter, you'll need to whip up a wiring harness that allows you to hook the voltmeter in between the battery and the charger. I run a lot of different cars, and way back in the beginning of the sport, it seemed like they all had different connectors on the batteries. I finally made up a bunch of adapters based on the 3-pin Ace/Deans connectors, which are available at almost all hobby shops. When I get a new charger, I get a set of connectors to fit it, and a pair of Deans plugs. I wire up a pair of adapters so that the male Deans plug goes to the charger and the female Deans plug goes to the battery. You could do it the other way around, but if you have a male Deans plug coming out of your battery pack, there's a chance it could short out on a metal surface by touching the exposed contacts.

Now that I have adapters to let me put Deans plugs on all the chargers and batteries, I have made up a simple harness to plug the voltmeter into the circuit. I clipped the probes off the wires that came with the charger. Then I connected the negative terminals of a pair of Deans plugs with a short piece of wire. The positive voltmeter lead went on the positive terminal of the female Deans plug, and the negative voltmeter lead went to the positive terminal of the male Deans plug. So when the charger gets plugged into the female Deans plug and the battery into the male Deans plug, current flows through the voltmeter along the positive wire.

The simplest charger you can get is a charge cord. These are often packaged with car kits and consist of a plug to fit the battery, a pair of clips to attach to the 12-volt supply battery, and lengths of wire to connect the two. One of the wires is a special resistance wire to drop the charge current to a level that the pack can accept safely.

The trouble with charge cords is that you have to monitor the charge at all times, preferably with a voltmeter as we've discussed, or you'll fry your pack for sure. Another problem is that the resistance wire gets very hot while it's hooked up. Use a charge cord when you have to, but approach it the way you would do dental work on a cobra—very cautiously.

A much better alternative is a simple timed charger. These are made by most manufacturers; the most popular units are from Astro Flight, Leisure Electronics, MRC, MRP,* and others. Associated* makes a timer that can plug into a charge cord to shut it off. These are the chargers with which you should start.

Simple timed MRC charger will fast and trickle charge as well as discharge typical car batteries.

For a little more money, you can get an AC/DC charger that runs from your house current. These will save you a lot of hassel; who wants to run out to the garage every time they have to charge a pack?

The Ram* Fool-Proof Charger deserves a closer look because it does something that other chargers don't. It comes with a heat detector; a pad that you can attach to your battery pack with a rubber band. Push the button, and it fast charges your pack for 20 minutes. Instead of looking for the peak voltage, it shuts off when the heat detector senses that the pack has warmed up to 110°. This approach is simple and guarantees never frying a pack, but it's no good for battery packs that are encased in hard plastic, since the heat sensor has to be resting directly on the pack.

Many of these simpler chargers have a circuit to discharge the battery. Why would you want to do this? If you start with a flat battery pack and give it a full charge, you'll get more of a charge into it. Furthermore, timed chargers shut off after a certain number of minutes, rather than sensing the state of charge of the pack; so if you have a partial charge, you could be overcharging before the timer shuts off. Discharging will prevent this. To avoid damaging your pack, don't discharge to a total pack voltage of less than 1 volt per cell. If, for some reason, it goes lower, trickle charge the pack before fast charging it.

Decide what you want to do before you invest in a charger. If you're serious, invest in a peak detector; you'll save money in the long run. For beginners, your minimum requirement is a charger that will fast and trickle charge your packs. Extras like AC/DC operation, digital read-outs and temperature sensing are well worth the extra money, and these chargers are often on sale at your local hobby shop. Use your basic understanding of what is happening inside your battery to decide what you need in a charger. Then go have fun!

**The following are the addresses of the companies mentioned in this article:*

Astro Flite Inc., 13311 Beach Ave., Marina Del Rey, CA 90292.

Leisure Electronics, 11 Deerspring, Irvine, CA 92714.

BoLink, 420 Hosea Rd., Lawrenceville, GA 30245.

Delta Mfg. Inc., 27 Racecar Ct., Lorimar, IA 50149.

Robbe, Suite 345/355, The Office Center, Plainsboro, NJ 08536.

Model Rectifier Corp., 2500 Woodbridge Ave., Edison, NJ 08817.

Model Racing Products, 18676 142nd Ave. NE, Woodinville, WA 98072.

Associated Electrics, 1928 East Edinger, Santa Ana, CA 92705.

Ram, 4736 N. Milwaukee Ave., Chicago, IL 60630. ■